The Engineering and Mining Journal

VOLUME 96 DECEMBER 6, 1913 NUMBER 23

Lithia Deposits of the Black Hills

By Victor Ziegler*

SYNOPSIS—Lithia deposits occur in pegmatite dikes of Precambrian age, in the Harney Peak district. Chief producing areas are near Keystone, Custer and Oreville. Amblygonite, spodumene and triphylite are the commercial lithia minerals, though many others exist. Spodumene is found in great log-like crystals. Other minerals occur in irregular pockets and nodules, often of great size, associated usually with milky quartz.

The lithia deposits of the Black Hills lie in the area of metamorphic rocks of Precambrian age thought, in part at least, to represent the Huronian system of the Lake Superior region. These rocks occupy the central core of the Black Hills and consist of a series of ancient sedimentaries now metamorphosed into slates, phyllites, quartzites, mica-, tourmaline-, garnet-, actinolite-, staurolite-, and quartz-schists, and gneisses, which are cut by a series of eruptives consisting of a prominent phase of basic rocks, now amphibolites, and a large massive silicic rock body, now granite gneiss. All, in turn, are cut by a great system of pegmatite and granite intrusions of less age, centering in intensity and magnitude in Harney Peak, the loftiest point in the whole Black Hills uplift.

Contact of Pegmatite and Schist, Showing Enrichment in Mica, Bob Ingersoll Mine, Keystone, S. D.

Open Cut at Etta Mine, Showing Spodumene Logs, Keystone, S. D.

Precambrian Rocks Form Core of the District

Previous to these intrusions the sedimentaries had been intricately folded and somewhat metamorphosed, while both previously and subsequently much faulting took place, making the structure of the region very complex and difficult to ravel. The metamorphism of the Precambrian rocks is more marked as we approach the granites and as has been suggested by Van Hise, is probably in part an effect of this intrusion. This Precambrian core is surrounded on all sides by the parallel fringes of the sedimentary formations, rising in the geological scale as we move away from the hills and representing more or less completely all geological epochs from the Cambrian to the Pleistocene.

The granites of Harney Peak were intruded as a great batholith and did not actually reach the surface until exposed by erosion. Their general character shows that up to the present time erosion has done no more than lay bare the upper portion of this great granite body. Accompanying these granites, there is a large series of pegmatite dikes and quartz veins. These, as a rule, are intruded along the schistosity of the metamorphics. They have affected the general topography of the region profoundly, rising in bold precipitous hills or picturesque needle-like and castellated forms above the schists, but due to the relatively higher rate of erosion, the pegmatites, when introduded into quartzites, occupy the valleys and the more gentle slopes. The pegmatites and their accompanying quartzose phases afford deposits of important mineral products, chief of which are mica, lithia, tungsten, tin and gold. Of lesser importance are deposits of beryl, niobium, tantalum, monzonite, barite and bismuth.

The important lithium minerals are amblygonite [$LiAl(F.OH)PO_4$], triphylite [$Li(FeMn)PO_4$], griphite (a complex phosphate of lithia, iron, manganese and magnesia), spodumene [$LiAl(SiO_3)_2$], lepidolite [$(LiKNa)_2$

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$(OH.F)_2Si_3O_9$] and petalite ($LiAlSi_4O_{10}$). Griphite, petalite and lepidolite have as yet not been used as a source of lithia, although the latter would seem to be high enough in lithia to merit earnest consideration at some future time.

Lepidolite occurs in micaceous aggregates, colorless or of various shades of green, lavender, lilac and brown. Rarely it occurs in exceedingly dense masses, which show no evidence of micaceous structure and possess excellent conchoidal fracture. The lilac and lavender lepidolite is highest in lithia content. Caesium and rubidium are present in some Black Hills lepidolites. Griphite is so far known only from the Black Hills and is a resinous, light- to dark-brown mineral usually suggesting resin jack in appearance. Very rarely it is jet black. It occurs in pegmatites in nodules and masses which show good conchoidal fracture, and are often as much as 50 and 60 lb. in weight. The percentage of lithia is too low to make it suitable as a source of this oxide. Triphylite, which occurs in a similar way, is of a brown to brownish-black color, and has a submetallic to dull luster. It has poor cleavages and is often coated with purple or deep-red purpurite (FeMN) PO_4. Spodumene has been used to quite an extent as a lithia mineral. It occurs in huge crystals, usually white in color, quite hard, fairly heavy (sp.gr. 3.1), and possessing excellent cleavage. On weathering, the spodumene turns chalky-white, unless stained by iron oxide, and disintegrates into a fine slivery or splintery mass, which is often almost fibrous. Petalite occurs in pearly-lustered, small, white and cleavable masses, that are very hard and comparatively light. It is too rare to be of any importance as a lithia mineral. Amblygonite is the most important of these minerals, both on account of its high lithia content and on account of its ready solubility and consequent easy treatment. It occurs in nodules often as much as 200 to 300 lb. in weight. They are usually white in color, not quite as hard as spodumene, a trifle heavier (sp.gr. 3.2), and do not possess as good cleavage. It is most easily confused with the albite and oligoclase with which it is associated but can readily be distinguished by its greater specific gravity.

Spodumene in Nearly All Pegmatites

Spodumene as an accessory mineral occurs in nearly all the pegmatites of the Harney Peak district. In a number, however, spodumene is so prominent as to replace practically all the feldspars and make the rock a quartz-spodumene rock carrying only subordinate amounts of the latter and other accessory minerals. Especially prominent are the Etta, the Bull Con, the Swanzy, the Wood Tin and the Dyke Lode claims near Keystone. The Hugo mine and the Equality Lode claims near Keystone and the Bond mine near Custer also carry appreciable amounts of spodumene, but are of chief interest on account of the accompanying amblygonite. The Etta deposit will serve best as an example of the spodumene deposits. This deposit is an oval, conical-shaped pegmatite body about 200 ft. in longest diameter on the surface, which forms the core of a small rounded hill, spoken of as Etta Knob, rising above the intruded quartzose phyllites and schists. This deposits has had quite a checkered career as a mine. It was originally worked for mica. Subsequently it passed into the hands of the Harney Peak Tin Co., and much work was done in search of cassiterite. Spodumene was next mined for several years. At the present time no work is being done, but the property is being held to await the exhaustion of the amblygonite deposits.

The deposit is opened up by a large open cut and by two tunnels, the lower of which is about 175 ft. below the top of the hill and cuts clear through the pegmatite from wall to wall. There are also several small tunnels and drifts and a shaft which are at present inaccessible.

Spodumene Crystals Attain Great Size

As shown in the open cut and in the tunnel the deposit possesses a roughly zonal structure. At the contact the pegmatite approaches in composition a typical granite, i.e., it consists of an aggregate of alkali feldspar, quartz, abundant biotite and muscovite. The individual minerals are quite coarse in grain and will average about ¾ in. in diameter. This zone grades quickly and irregularly into a zone of giant pegmatite, consisting essentially of milky quartz masses penetrated and cut through in every imaginable direction by huge crystals of spodumene. These lie so irregularly as to suggest in appearance a jumbled mass of logs. Rarely the logs are arranged in star-shaped clusters. Many attain a length of 30 ft. and a diameter of 3 ft. The largest so far found was 42 ft. in length and 5 ft. 4 in. in maximum diameter. The best and largest spodumene crystals occur on the east side of the deposit. On the west side the spodumene is quite prominent but occurs in smaller masses. At the point of intersection of the spodumene logs one is usually continuous while the other is quite decomposed and cut off.

Irregularly placed in about the center of this zone, there occur irregular pockets of an aggregate of muscovite and quartz suggesting greisen in appearance and carrying fair amounts of disseminated grains of cassiterite and columbite. This is of importance only on the east side of the deposit. On the west side these pockets are absent or very restricted. In some of these aggregates the mica flakes reach a diameter of several inches. Triphylite, in nodules up to a foot across, small crystals of amblygonite, tapiolite, struverite and cupro-cassiterite occur, disseminated in this zone. Often the spodumene logs are surrounded by fine, scaly muscovite masses plentifully peppered with columbite and cassiterite grains. Stannite also was found in such an aggregate. Although this second zone is not sharply marked, it grades into a central zone quite rich in spodumene but characterized predominantly by large masses of feldspar (mostly microcline and oligoclase) and quartz. These masses are often as much as 6 to 7 ft. across. Large masses of pale-green beryl, aggregates of green scaly lepidolite, and of lamellar albite are also prominent in the central portion.

It is difficult to conceive of the extreme abundance and huge size of the spodumene crystals as shown in the open cut. One cannot help but marvel that molecular forces were powerful enough to govern the deposition of substances for such distances as 42 ft., and not only definitely orient all the matter over this distance, but also exclude rigorously all foreign material as well. In the tunnel, 175 ft. below the top of the hill, the pegmatite body has widened and shows spodumene in as large crystals and in as great abundance as on the surface.

The Hugo and Dyke Lode near Keystone, the Wood Tin claim between Harney City and Hayward, and the Bond mine near Custer, show spodumene logs on the surface apparently as large as those in the Etta. Conditions of occurrence are practically the same. The Bull

Con and Swanzy claims near Keystone, where exposed, show spodumene in as great abundance as in the Etta, but in crystals of smaller size.

Spodumene varies in lithia content quite decidedly. Thus various analyses made at the South Dakota State School of Mines show percentages from 1.18 to 6.16. The theoretical lithia content is 8.4%, but as a rule some lithia is replaced by soda.

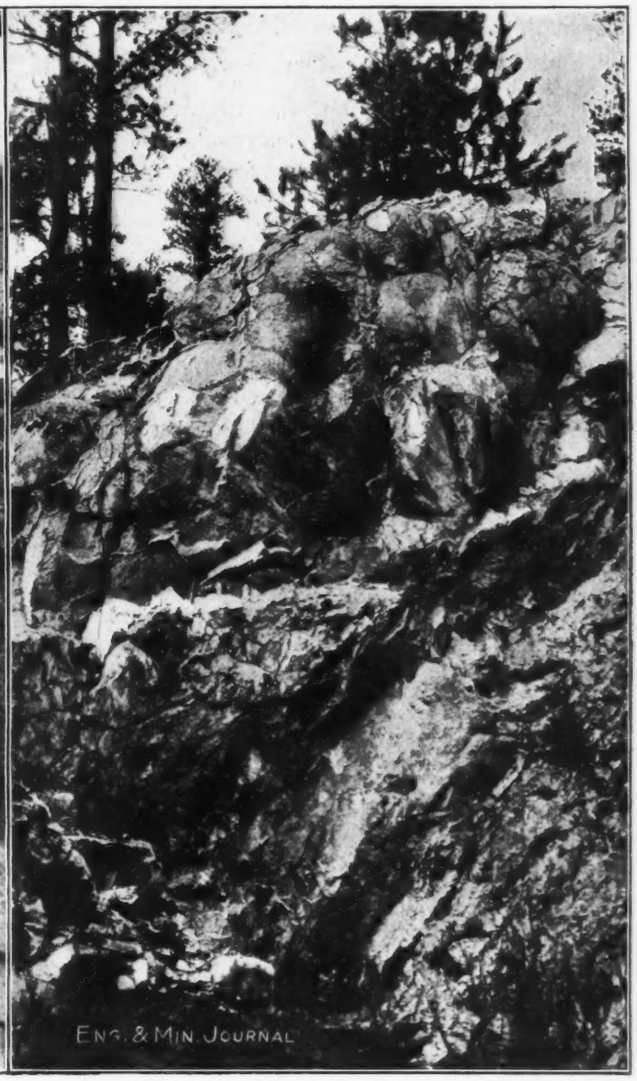
Up to the last five or six years spodumene was the chief source of lithia and was mined extensively at the Etta mine. Since then, however, owing to the opening of amblygonite deposits none has been produced.

The first spodumene from the Hills was put on the market in 1900. Since then and up to 1908 (with the exception of 1905), spodumene production has averaged less than 200 tons per year, the maximum being over 400 tons in 1904. The total production is about 1400 tons. The value depends on the lithia content and fluctuated in the above years from $9 to $40 per ton.

Amblygonite Found in Nodules and Pockets

The more important amblygonite deposits are the Hugo, Peerless and Bob Ingersoll near Keystone, the Nichols near Hayward, the Tin Queen near Oreville and the Bond near Custer. The Hugo mine may best serve as an example of these deposits. It is located southwest of Keystone and about one mile northwest of the Etta Knob. This deposit is a large pegmatite body of oval character, similar to the Etta and widening downward. At the contact with the schists there is usually an enrichment in black tourmaline in regularly arranged streaks and masses. This is quickly followed by an enrichment in coarse, irregular muscovite books occurring in large pockets and shoots, and mined at the present time for scrap mica. This gives place irregularly to coarse granite, which grades into giant pegmatite made up of large masses of feldspar and quartz interspersed with pockets of coarse plumose muscovite-book aggregates, streaks of muscovite-quartz rocks carrying cassiterite and columbite, with the latter in masses up to 100 lb. in weight. There is much coarse pale-green and white beryl, blue apatite, lepidolite in pale-green micaceous masses, and triphylite up to 50 and 60 lb. in weight. There are logs of spodumene suggesting in size and occurrence those at the Etta. The central portion of the deposit gives at first sight the impression of one huge mass of milky quartz. This carries

Open Cut at Hugo Mine, Keystone, S. D.



Amblygonite Nodules in Pegmatite, Hugo Mine

some large feldspar masses, some beryl, blue apatite, triphylite, and amblygonite. The latter mineral occurs quite irregularly in nodules and pockets, sometimes of great size. Thus one shoot of practically solid amblygonite showed on the face of the open cut for a distance of 15x22x40 ft. Masses 300 to 400 lb. in weight are frequently found, but there is no regularity in their occurrence. Their presence cannot be foretold until they are actually encountered. Amblygonite is more liable to occur when the milky quartz masses carry triphylite, spodumene and lepidolite, even if only in small amounts. When the amblygonite masses lie next to triphylite, they tend to be higher in lithia than when they occur near spodumene. In the former case most or all of the available fluorine seems to have been taken up by the triphylite while in the latter case it enters into the amblygonite. This deposit is quite vigorously worked by the Reinbold Metallurgical Co., open-cut methods being employed. Cassiterite, columbite, beryl, apatite, triphylite, and lepidolite are all saved incidentally while taking out the amblygonite, and are held awaiting future market demands.

Other Deposits in Which Amblygonite Is Found

The Peerless deposit which is mined by the same company is of similar character. Spodumene does not occur here nor at the Bob Ingersoll nor the Nichols claims, except in rare and small crystals. The occurrence of amblygonite at the Bond mine near Custer is similar. The deposit, however, is not of such great size and occurs in a roughly north- and south-striking dike, rather than a cone-like body.

The Nichols mine near Hayward is quite unusual. Here amblygonite is found in loose brecciated material in well rounded, boulder-like nodules, immediately underneath the basal sandstones of the Deadwood formation. The amblygonite is traversed by cracks and these and the outside are heavily coated by iron oxide derived by leaching from the overlying sedimentaries. The amount of iron oxide so present reduces the lithia percentage of the whole below the marketable limit. Geologic conditions suggest that the amblygonite is not in place, but has been transported here probably by rolling partly down hill, before the Deadwood formation was laid down.

The first amblygonite was found at the Tin Queen mine in 1903. It was first mined in 1905. Since then the production has varied from a few tons to 800 tons per year (1912), the total production from 1905 to Sept. 1, 1913, being about 2800 tons. The value has fluctuated greatly, depending on production and on the lithia content. Soda, as in spodumene, replaces part of the lithia. At present amblygonite is sold on the basis of 9% lithia content. Prices in the last eight years have run from $10 to $45 per ton.

Deposits of Other Minerals Worked

Lepidolite which may serve as a possible source of lithia in the future is prominent only at the Bob Ingersoll and possibly the Peerless mine, the lavender or lilac-colored variety being the highest grade. At the former this occurs somewhat like amblygonite in irregular shoots. One such of deep-lilac lepidolite is 2½ ft. thick and shows for 5 to 6 ft. in a small open cut. Some pale-lilac lepidolite occurs at the Bond mine. Green lepidolite is quite abundant at the Peerless, the Hugo and other claims.

Triphylite is of quite common occurrence in all of the pegmatites so far mentioned. It occurs much like amblygonite, but is more persistent and reliable in occurrence. Nodules up to a foot in diameter are common. These favor the coarser pegmatites. About 60 tons were taken from the Dyke lode, ¾ mile northwest of Bismuth, in 1907 and 1908, and about 40 tons were taken at various times from the Lost Bonanza (now the Mica King) about one mile south of the Etta. All was shipped to Germany by the Reinbold Metallurgical Co. No triphylite has been used for lithia extraction since the amblygonite deposits have been opened. Owing to its high lithia content it will probably take the place of amblygonite when the deposits of this mineral become exhausted.

Lithia-Bearing Pegmatites Formed by Influence of Rock Crystallization

The lithia-bearing pegmatites are simply those portions of the Harney Peak granitic magma which are expelled during the process of crystallization and which do not enter into the composition of the essential minerals of the granite. They are the last to crystallize and are forced out to the margin of the granite into cracks developed by cooling and into the fissures of the country rock. Since these last molten portions are concentrations of water and volatile gases as SO_2, B, Cl, F, and others, usually spoken of as mineralizers, their fluidity is high. Most metallic minerals, as cassiterite, wolframite, columbite, are soluble in these mineralizers and are carried out in solution, together with some quartz and feldspar. The metals also tend to increase the fluidity of such a fusion. This extreme fluidity affords the necessary condition which allows of the formation of crystals as much as 42 ft. in length. Water is held in solution as vapor under pressure. As the different consituents are eliminated the fusion becomes more and more watery until it exhibits a complete gradation into water solutions at high temperatures.

Thus the Harney Peak granite, consisting of orthoclase, microcline, oligoclase, quartz and muscovite, shows complete gradations into giant pegmatites with their large quartz and feldspar masses, their huge crystals of spodumene, and their hosts of rare minerals as columbite, cassiterite, uraninite, tapiolite, triphylite, griphite, etc. These show gradations into the large milky quartz masses with their amblygonite, tourmaline, and apatite enrichment which represents a slightly later stage in crystallization. Pegmatite can be directly traced into quartz veins at a number of places as, for example, at the Equality lode near Keystone. These closely related quartz veins are usually rich in muscovite, tourmaline and griphite, and carry varying amounts of one or more of the following minerals: Barite, cassiterite, wolframite, hübnerite, gold and bismuth tellurides, siderite and other carbonates. Hence we find a perfect gradation from the true typical granite into the coarse-grained pegmatite, and from the latter, into the true quartz vein, which is the last stage in the whole series and represents the residue highest in water content, from which most of the rarer substances have been removed during the crystallization of the pegmatites.

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Iridium has been discovered in South Africa, according to information received from the Commissioner of Customs and Excise at Pretoria. The Secretary for Mines reports the discovery in the Heidelberg district of a small gold reef which also contains iridium. A test showed the presence of 8dwt. gold, 10dwt. silver, 3½dwt. iridium, and a trace of platinum per ton of ore.

Scandinavian Mining and Metallurgy

SPECIAL CORRESPONDENCE

The mineral and metal output of Norway in 1912 shows about a 35% increase both in value and in number of men employed, but it should be noted that the increase is practically confined to those propositions which began working before restrictions of the concession laws became operative some five years ago. At that date all appreciable progress in new mining ventures practically ceased. So far as the 1912 output and values are concerned, it may be pointed out that apart from the 44,500 tons output of the Salangen iron mines (which shut down in that year), the bulk of the iron-ore output as represented by Sydvaranger, is not dividend-paying. In the meanwhile this company's undertaking, though still more or less in its construction stage, is, at present, shipping an average of about 45,000 tons of slig and briquettes per month, and it has been recently decided to carry on the extension to a point whereby an annual output of 700,000 tons will be secured. The installation of the new machinery in the separation works is well forward, and will be probably completed by the end of the year.

SWEDISH IRON ORE TO AMERICA

The Swedish minister at Washington has strongly advised the home authorities to increase the Norrbotten ore shipments to the United States. He bases his recommendation on the fact that the new tariff gives it free admittance, and that the leading steel firms are prepared to take all of this ore they can get sent them. The reserves of the Norrbotten ore, which has an Fe content of about 63%, are computed at 1,000,000,000 tons.

The Swedish Luossavaar Kirunavaarabolaget has notified the railway authorities that, in 1915, Lappland iron ore to the amount of 3,738,000 tons will be mined for shipment.

ELECTRIC IRON-ORE SMELTING IN NORWAY

The electro-metallurgical committee in its report on the smelting operations at Hardanger arrived at the conclusion that the economical failure of the Elektrometal method, using coke as reducing material, was caused by the poor-grade ores employed, and errors in the selection of the roaster and electric equipment. French interests are, at present, converting the plant into an aluminum-cable factory, that metal having lately been increasingly substituted for copper.

The failure of the Hardanger attempt at electric iron-ore smelting on a commercial basis, has concentrated attention on the Norwegian Bie-Lorentzen smelter at the Tinfos iron works, in Telemarken. At a recent meeting of the shareholders of the Tinfos company, the chairman, Herr Christiansen, said that the initial difficulties were being gradually overcome. The total charges in connection with the production of the pig iron had now worked out at 75 kroner (1 krone equals 26.8c.) per ton. The sale price was from 81 to 82 kroner per ton, and there was still a prospect of bringing the cost charge further down. The product cost more than was anticipated, but this was also owing in a measure to the fact that ore, and especially coke, had become dearer than was expected. The smelting at Tinfos, it should be mentioned, commenced in August, 1912, with furnace No. 1, with furnace No. 2 in December, No. 3 in March, 1913, followed later on by No. 4. The working for last year showed a loss, which is attributed to a number of unexpected difficulties, and mishaps, including labor troubles.

However, the results have been sufficiently encouraging to induce Herr Kammerherre Cappelen, the owner of the well known Ulefos mines and foundries, to adopt the process, or a modification of it for his works. He has applied for a concession for a high-tension connecting with Vrangfos and Eidfos falls, in Telemarken, with a view to the installment of electrochemical works at Ulefos. As Herr Cappelen's methods are known by repute to be anything but speculative, his decision has aroused much hopeful anticipation in those who desire to see a solution of Norway's iron ore-coke smelting problem.

A. S. Tysse Falls, Norway, has concluded a loan of $1,750,000 at 5½% to extend the Odda power plant, in Hardanger. This now develops 86,340 e.hp., and the extensions will give 13,000 more.

CANADIAN COPPER ORE TO SULITELMA

A parcel of 100 tons of copper pyrites from Canada has been delivered by a Norsk-American boat at Bergen, and transhipped via Fineidet to the Sulitelma smeltery. The Swedish-American engineer, Mr. Warn, says that the Canadian Copper Co., which smelts its ore in blast furnaces, will try the Knudsen process at Sulitelma. At the same time Mr. Warn proposes to investigate the methods of the Hybinette electrolytic process in Norway.

The Steel Corporation's Proportion of Business

The annual report for 1912 of the American Iron & Steel Institute—which takes the place of the American Iron & Steel Association—gives a table of production, showing the proportion of the total make of iron and steel and the production of iron ore credited to the United States Steel Corporation and the outside or independent producers during that year. We take from this table the figures showing total production and the percentages credited to the corporation and other producers:

Ore, etc.:	Total Tons	Percentages: Steel Corp.	Percentages: Independent
Lake Superior iron ore	48,221,546	50.46	49.54
Total iron ore	55,150,147	47.92	52.08
Coke	43,983,599	38.01	61.99
Iron and Steel:			
Spiegel and ferro	221,724	80.82	19.08
Pig iron	29,505,213	47.47	52.53
Total furnace products	29,726,937	47.72	52.28
Steel ingots, all kinds	31,251,303	54.08	45.92
Steel rails	3,327,915	56.27	43.73
Structural shapes	2,846,487	49.83	50.07
Plates and sheets	5,875,080	50.37	49.63
Wire rods	2,653,553	63.20	36.80
Other rolled products	9,953,806	40.56	59.44
Total rolled products	24,656,841	48.52	51.48
Wire nails, kegs	14,659,700	49.30	50.70
Tinplates	962,971	60.37	39.73

Other finished rolled products include nail plate, merchant bars, rolled forging blooms and billets, semi-finished products for export, etc. Wire nails are given in kegs of 100 lb. each, the total being equal to 65,445 long tons. Semi-finished products, except those exported in such forms, are not included.

High-Grade Lime Deposits Exist Near Buenos Aires, Argentina, and a movement is on foot to standardize their product in terms of CaO, a certain amount to be valued at one peso.

The United Verde's 400-Ft. Steel Chimney

By C. W. Cromwell*

The United Verde Copper Co. is building as a part of its new works, at Jerome, Ariz., a chimney which is believed to be the tallest steel stack in the world. This chimney is 30 ft. in diameter inside the brick lining, 30 ft. 9½ in. inside of the steel shell, and 400 ft. 1 in. from top of foundation to top of steel. The unusual size of this structure, the connections for three flues, and the protection of the steel plate from the flue gases, caused several interesting problems in the design.

The diameter and height of the chimney were determined by the draft calculations; the diameter and height of bell were made one-eighth of the height of chimney, or 50 ft. The brick lining was supported on the legs of circular angles riveted to the inside of shell and spaced 15 ft. apart. By this method, the bearing capacity of the brick is not exceeded and any section can be replaced without affecting the others. The weight of brick is carried directly down the shell and was added in when computing the maximum stresses on the compression side, but was neglected on the tension side as it was assumed that the maximum wind might occur before the chimney was lined.

The wind load was assumed to be 50 lb. per sq.ft., or 25 lb. per sq.ft. on the projected diameter, equal to 770 lb. per ft. of height. The dead load was taken as the actual weight of steel plus the weight of brick lining assumed at 112 lb. per cu.ft. The following unit stresses were used: Tension, 16,000 lb. per sq.in., on net section; compression, 10,000 lb. per sq.in., on gross section; shop rivets, 10,000 lb. per sq.in. for shear and 20,000 for compression; field rivet values 80% of shop. The section modulus of any section was computed by multiplying the area of the inside of shell by the thickness.

In order to find the points where assumed sections of plates and spacing of rivets changed a formula was derived as follows to eliminate the customary "cut and try" method.

Where

- h = Distance in feet from top of chimney to section in question;
- r = Least value rivet in shear or bearing;
- d = Diameter of rivet in inches;
- a = Distance between rivets in inches;
- t = Thickness of plate in inches;
- W_s = Weight of column of steel 1 ft. high. (For 1 sq.in. of steel is weight on circumference of length $\frac{1.0}{t}$);
- W_b = Weight of brick as above. (For 1 sq.in. of steel is $\frac{3.0}{t}$);
- S_c = Allowable compression per square inch on steel plate, to develop rivets in joints;
- S_t = Allowable tension per square inch on steel plate, to develop rivets in joints;
- M = Moment from wind in inch-lb. = $4620\ h^2$;
- M_s = Section modulus.

Then

$$S_c = \frac{r}{at} \quad (1)$$

$$S_t = \frac{r}{(a - d - \tfrac{1}{8})\,t} \quad (2)$$

$\frac{M}{M_s}$ = *actual stress due to wind on either tension or compression side of chimney* (3)

$$\frac{M}{M_s} + hW_s + hW_b = \frac{r}{at} \text{ or } \frac{4620\ h^2}{M_s} + hW_s + hW_b = \frac{r}{at}$$

(compression side) (4)

$$\frac{M}{M_s} - hW_s = \frac{r}{(a - d - \tfrac{1}{8})\,t} \text{ or}$$

$$\frac{4620\ h^2}{M_s} - hW_s = \frac{r}{(a - d - \tfrac{1}{8})\,t} \quad \text{(Tension side)} \quad (5)$$

All the quantities in the above equations are known except h, which can be readily solved from (4) and (5) as a quadratic. The minimum value found in the two equations should be used, which was always to be on the compression side. This method proved to be a great labor saver, the known values were substituted in equations (4) and (5), and getting these equations in the form of the standard quadratic $ah^2 + bh + c = 0$, the value h became $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, which was solved by the aid of the slide rule. An example of the use of the formula will be given.

To find the limiting distance h with ¼-in. plate and ¾-in. rivets spaced 2¼-in. centers.

$\frac{3000}{2\frac{1}{4} \times \frac{1}{4}} = 5330$ = allowable compressive stress in plate.

$\frac{3000}{1\frac{3}{8} \times \frac{1}{4}} = 8725$ = allowable tensile stress in plate.

Weight of steel per linear inch circumference is 0.98h, or 3.92h for 1 sq.in. of steel. Weight of brick per linear inch circumference is 3.00h, or 12.00h for 1 sq.in. steel.

Total per linear inch circumference is 3.98h, or 15.92h for 1 sq.in. steel.

Then, $\frac{4620h^2}{26750} + 15.92h = 5330$, and h = 140 ft. = allowable depth on compression side.

Also, $\frac{4620h^2}{26750} - 3.92h = 8725$, h = 238 ft. = allowable depth on tension side.

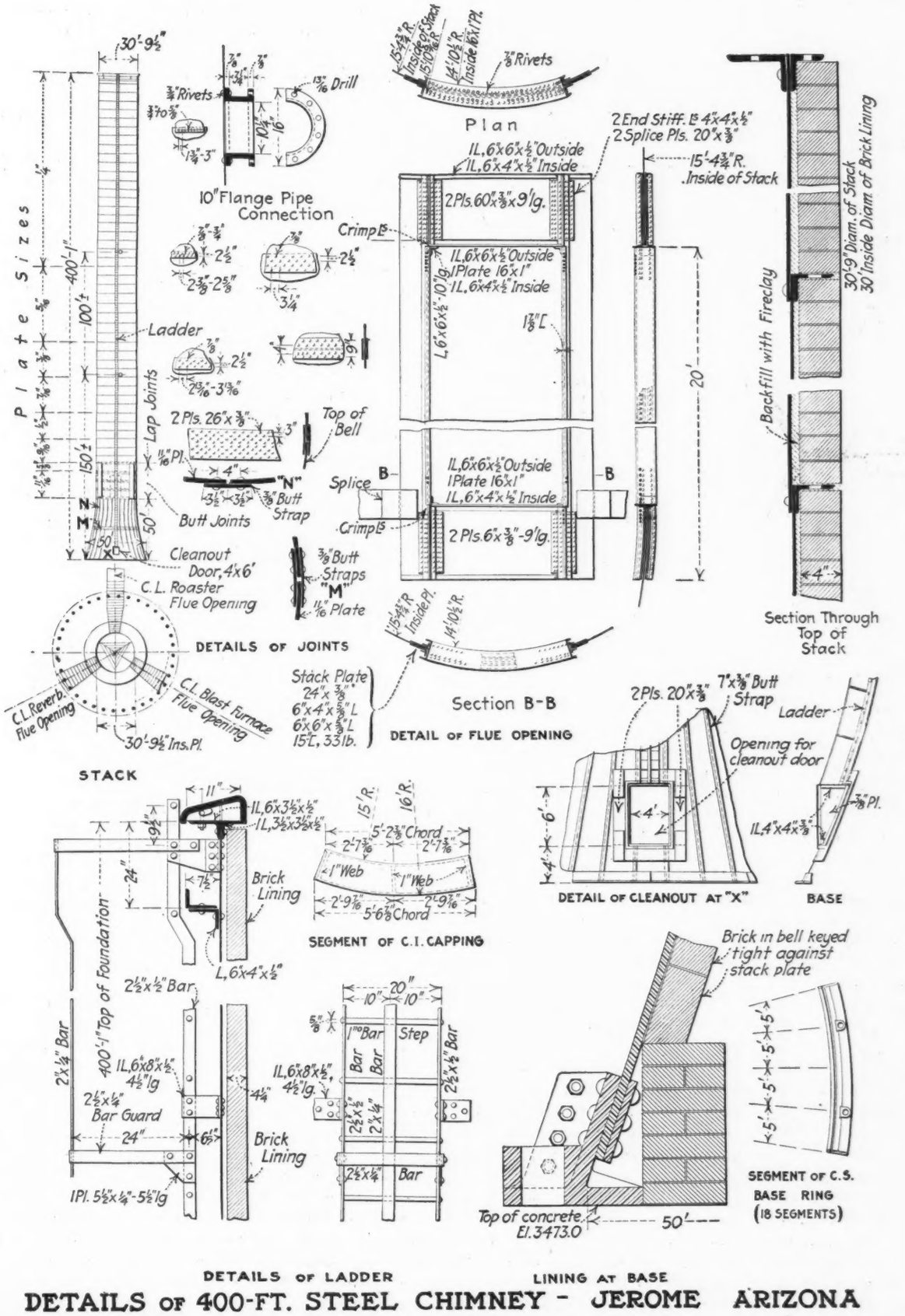
This shows that the assumed plate and rivet spacing should extend 140 ft. from top of chimney.

The first change in section was designed to be made at 160 ft. from top of chimney, and the others at 58, 29, 29, 22, 22, 7½ and 22½ ft. farther down, but this spacing was slightly changed to fit plates ordered. The thickness of plates, diameter of rivets, and details of joints are shown in Fig. 1. The bell was made of 36 plates $\frac{11}{16}$ in. thick running vertically, with one horizontal butt-joint splice, to top of bell. Two plates 26x⅜ in., with four rows of rivets each side connected the bell with the main shaft. These plates were made unusually large to give additional stiffness and prevent any possible tendency to flatten the shell due to the curvature of the bell.

At the top of the bell it was necessary to provide three openings 120° apart for the reverberatory, blast-furnace and roaster flues. The sizes of these openings are given on Fig. 1. The bottoms of these openings were at the same elevation—the top of the bell. At these openings a lower unit-stress was used on the shell plate, and at each side of them the plates were reinforced as shown in detail. This T-section reinforcement was designed as a column

Note—Published simultaneously with "Engineering News."

*Structural engineer, Repath & McGregor, Douglas, Ariz.



DETAILS OF 400-FT. STEEL CHIMNEY - JEROME ARIZONA

to take a load equal to the maximum stresses the plate in half the opening would have taken. At the tops and bottoms of these openings, built-up girders were riveted

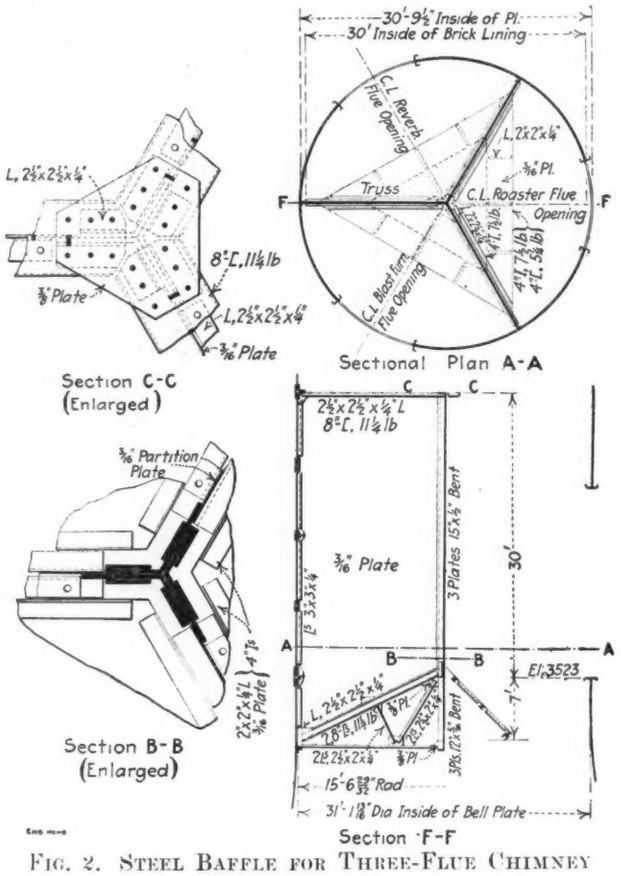


Fig. 2. Steel Baffle for Three-Flue Chimney

to both sides of the shell plates, and were designed to take load equal to the maximum stresses at these points.

The top of chimney is stiffened by outside and inside angles, the former supporting a cast-iron coping made up of 18 segments. This coping protects the steel and makes a good finish for the top. Two feet below the top there is a built-up Z-section with the outstanding leg turned up. This section acts as a strut and is to be used as a painting ring.

As previously stated, the brick lining is supported every 15 ft. by angles riveted to inside of shell; the angles are spliced and also act as stiffeners for the shell. At the bell the brick lining rests on the foundation and follows the contour of the bell to the top without any supporting shelf angles. Standard-size common brick is used, as in the remainder of the chimney, laid in rings and keyed against the bell plate.

There is a steel ladder running from bottom to top of the chimney and two feet back is a vertical bar connected to the ladder every 5 ft. and acting as a guard.

At points 150 and 250 ft. from the base there are flanged pipe connections with bolted cover plates to allow for inspection or tests. There is a large cleanout door at the base used also for erection purposes. Between adjoining flue openings, there is a baffle-plate extending from the shell to the center of chimney. These baffles extend from about 7 ft. below the bottoms of the flue openings to the full height (30 ft.) and cause the flue gases to come together while moving in practically parallel courses.

At the bottom of the bell, the plates are triple riveted to a cast-steel base ring, made up of 18 segments which are bolted at flanged ends and spliced with a reinforcing plate. This ring is connected to the foundation by 36 anchor bolts 4 in. in diameter by 11 ft. 2 in. long. At the lower end of these bolts a cast-iron washer 1 ft. square gives them a positive connection under the reinforcing rails.

The foundation is octagonal with a short diameter of 70 ft. and a depth of 10 ft. Piers for some of the flue columns are connected to this foundation but do not affect the general design. It is made of concrete with mix proportions of 1:3:6, the lower 3 ft. with a maximum of 2½-in. stone, the next 5½ ft. with a maximum of about 18-in. boulders and the next 1 ft. 5 in. with 2½-maximum stone and a 1-in. finish of a 1:1 mortar. It is reinforced top and bottom with two layers of old 45-lb. rails laid at right angles. The underlying sand is a coarse gravel partly cemented. The maximum bearing pressure at toe is about two tons.

The total weight of this chimney is about 875,000 lb. The erection rigging consists of a steel frame of two decks, the upper one supporting a guyed derrick, the mast of which is at the center of the chimney. The falls are led down through the center of motion to the chimney

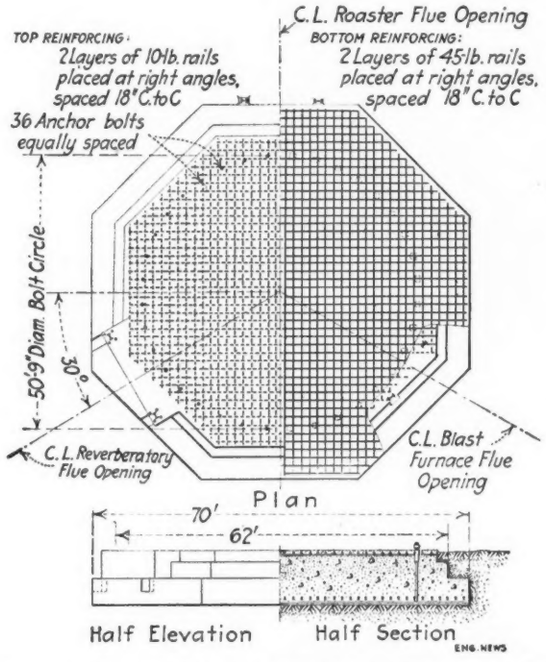

C.L. Roaster Flue Opening
TOP REINFORCING:
2 Layers of 10 lb. rails placed at right angles, spaced 18" C. to C
BOTTOM REINFORCING:
2 Layers of 45 lb. rails placed at right angles, spaced 18" C. to C
36 Anchor bolts equally spaced
50'-9" Diam. Bolt Circle
30°
C.L. Reverberatory Flue Opening
C.L. Blast Furnace Flue Opening
Plan
70'
62'
Half Elevation
Half Section
ENG. NEWS

Fig. 3. Foundation for 400-Ft. Steel Chimney

base, and through the cleanout door to an electric hoist. The frame will be raised by means of chain hoists attached to the upper sheet of the chimney. For placing the brick lining a similar scheme will be used, the frame being raised by means of chain hoists attached to shelf angles. These shelf angles have been provided with holes for such connections.

The chimney was designed by Repath & McGregor, engineers, Douglas, Ariz., who are designing the entire smelter. C. W. Cromwell, structural engineer, was in personal charge of the chimney design, with C. W. Brunskog as designing draftsman. The steel was fabricated and is being erected by the Chicago Bridge and Iron Works, of Chicago.

Copper Prices, Consumption and Supply

By Heath Steele*

SYNOPSIS—A slight decrease in present prices of copper would eliminate the small producers. Arguing from past figures the world's demands for copper are likely to increase faster than will copper production. Therefore, it is more likely that future prices of copper will be higher than recent prices, rather than lower.

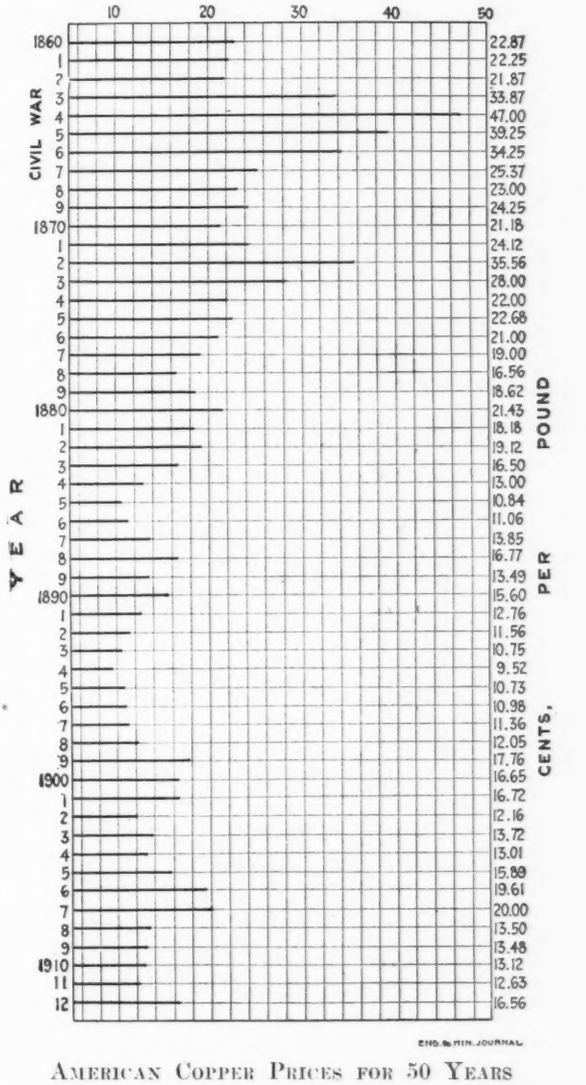
In a previous article published in the Engineering and Mining Journal, Aug. 9, 1913, on the "Cost of Copper," I stated that the price of the metal was subject first to the law of demand; second, to the supply, and again the supply would be regulated by the cost of production. The general conclusion from statistics gathered in that article was that the cost of the world's copper was about 10.5c. per lb. for all operating charges, but not including investments in mining property. Further, that a price of 14c. to 15c. per lb. for copper seemed necessary to provide for the return of capital invested in mining property and to give the profits demanded of the business. If this conclusion is correct, or nearly so, we then have a sound basis for thinking that the price of copper will not average below this point.

Some of the largest producers would only about break even on 12c. copper and others would even operate at a loss on a better market. If copper falls below the price that returns all producers a fair profit, and remains there for any length of time, the small producers will naturally be forced to close down. I shall try to show further on that the world needs all the copper it is getting; therefore, if the production from the concerns operating on a narrow margin is cut off, the principal producers would be in actual control of the market; the corollary follows that they would demand and obtain a good price. There is nothing new in this; it has always been accepted in a general way; but the factors, cost, supply and demand, are not clearly understood by all.

Price Records

The accompanying table and chart shows the record of copper prices for Lake copper from 1860 to the end of 1912. Conditions have changed to such an extent within the last 20 years that it is doubtful whether past records of prices are of much value in forming an opinion as to future prices. However, we may get in a way a confirmation of the inference that a price of 14c. to 15c. per lb. is necessary to meet all demands of the producers.

Starting with 1860, the highest price on record is 55c. for the month of July, 1864; the average for the year, 47c. per lb., is also the highest yearly average. Beginning from a low price of 17.5c. in July, 1861, the price started upward and continued so until it reached the peak of 55c. From this high record it gradually declined in curves until it reached an apparent level of about 23c. in the middle of 1867. From this date until the middle of 1871 it fluctuated from 19c. to 27c. We have here a period of about seven years during which the price was affected by the Civil War, which was also the cause of inflated money. The Lake Superior district was then producing about 70% of the copper of the United States. At the same time Lake copper was selling for 55c. in America, tough copper was selling for about 21.22c. per lb. in London, or less than half of the American price. If we were to be thrown into such a state of affairs at the present time and our mines forced to curtail their production even one-half, it is probable we would see a repetition of inflated prices; in fact, the situation would be so acute it is hard to foresee just what would happen, Now we are producing over half of the world's output, while even as late as 1880 our proportion was only 17 per cent.



American Copper Prices for 50 Years

If we are to consider anything like normal conditions the first peak indicated by the chart must be left out. Since the Civil War period the price of copper has fluctuated, or rather we have had well defined waves of high prices six times, including the present one. In 1872 it rose from a low price of 21.188c.; in 1870 to 35.56c.; from this point it fell to what was then a new low yearly record since 1860, 16.56c. per lb. In 1880 it had worked back to 21.43c., and from that date steadily declined until

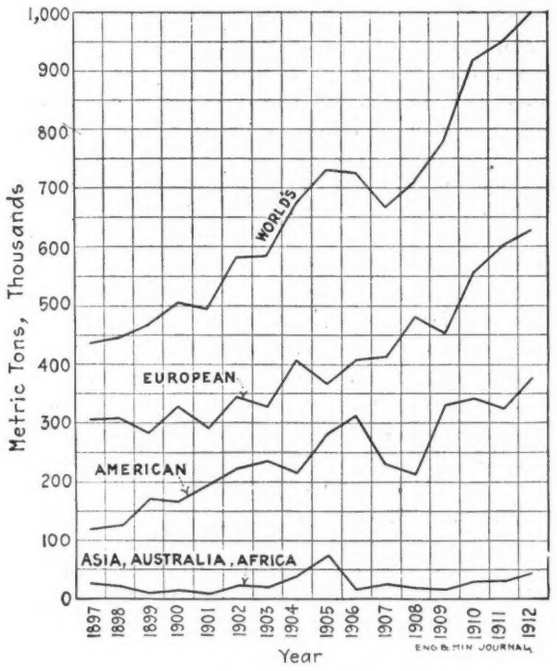
*52 William St., New York.

it reached another new low record of 10.84c. In 1888 copper was again selling for 16.77c., and was fairly steady between this price and 15.60c. to 1890, after this it gradually fell until it reached the lowest price on record for Lake copper, 9c. per lb., the yearly average was 9.52c. Since the low prices of 1894 there have been three big waves: 1894 to 1902, 1902 to 1911 and 1911 to the present movement, which has yet to work itself out. The peak of the 1894-1902 movement was reached in April, 1899, at 19⅜c. and extended to the latter part of 1901. The 1902-1911 movement started at a low point of 11c. in January and reached its highest point, 26¼c. in March, 1907, and ended in May, 1911, when the average price for the month was 12.214c. per lb. From this point it again started upward, and as stated, the full swing has yet to be completed. Granted that the price will continue to work in curves, and there is no reason to suppose it will not, a gradual rise in the price of the metal since 1894 and its continuance is evident from a study of the rise in the base price of each wave.

Five of the movements mentioned as occurring since the Civil War have been the result of industrial booms and consequent depressions, aided once or twice by attempts at controlling the copper market by certain interests. The sixth upward swing was started about the middle of 1911 and was from all appearances caused more by the normal growth of consumption than to any unusual industrial movement. The high crest of this wave to date was reached about September, 1912, and after remaining fairly steady for four months, the price began to recede until the average of March, 1913, was 14.93c. It again rose to 15.73c. for May and then fell to 14.56c. for July. At the present, September, 1913, it has again worked back to about 17c. Referring to the base line of the long upward swings; in 1911 it was 12.21c.; 1902, 11.55c.; 1894, 9c.; showing a rise of 3.21c. since 1894. If we were to consider the short movement in 1913 with a base of 14.56c. the rise would be 5.56c. per lb. It is possible to obtain numerous averages from past prices but, they all indicate that 14c. to 15c. has been a normal price for the metal. For example, the average price for 10 years ended 1905 was 13.79c.; 1906, 14.515c.; 1907, 15.30c.; 1908, 15.44c.; 1909, 15.06c.; 1910, 14.70c.; 1911, 14.71c.; and 1912, 15.15c., averaged for the 10 years to each date.

Past Consumption

The tables on consumption and production that follow were compiled from figures given by the Metallgesellschaft, which obtains many of its figures from the Engineering and Mining Journal, the others from Government reports, the Copper Producers' Association, and estimates by experts. The tables and charts given herewith tell a wonderful story of the increase in use of copper. Since 1897 the consumption has increased from 435,700 to 1,040,200 metric tons, or in other words, the world is using 604,500 tons, or 139% more copper per annum today than it was in 1897. By continents the increase has been: Europe, 105%; American, 218%; Australia, Asia and Africa, 233%. The American consumption represents all copper consumed in the United States, British North, South and Central America. Outside of the United States the American consumption was estimated at 500 metric tons in 1897, in 1912 it was estimated at 3000 tons, an increase of 500%. The consumption of the United States has risen from 117,400 to 371,800 metric tons in 1912, an increase of 217% for 16 years. Here we have evidence that the greatest percentage of increase is in the countries that are the least developed, which seems perfectly natural. Turning to the European countries we find the following percentages of increase: Italy, 370%; Austria-Hungary, 182%; Russia, 163%; Germany, 158%; miscellaneous European countries, 150%; and the lowest of all, France and England, showing an increase of 94 and 44.5%, respectively.



World's Copper Consumption

WORLD'S CONSUMPTION OF COPPER

(Metric Tons)

	Europe	Australia, Africa and Asia	America	World
1897	305,800	12,000	117,900	435,700
1898	308,000	10,700	121,800	440,500
1899	286,600	6,500	170,100	463,200
1900	328,200	10,200	169,700	508,100
1901	293,500	8,500	191,100	493,100
1902	341,900	17,200	223,400	582,500
1903	330,300	17,600	238,800	586,700
1904	402,900	38,800	220,800	662,500
1905	370,200	73,000	284,200	727,400
1906	404,800	12,000	305,800	722,600
1907	411,600	23,000	229,000	663,600
1908	480,500	14,800	211,200	706,500
1909	452,600	11,600	323,300	787,500
1910	550,100	20,700	342,900	913,700
1911	602,100	26,700	324,900	953,700
1912	625,000	40,400	374,800	1,040,200

EUROPEAN CONSUMPTION OF COPPER

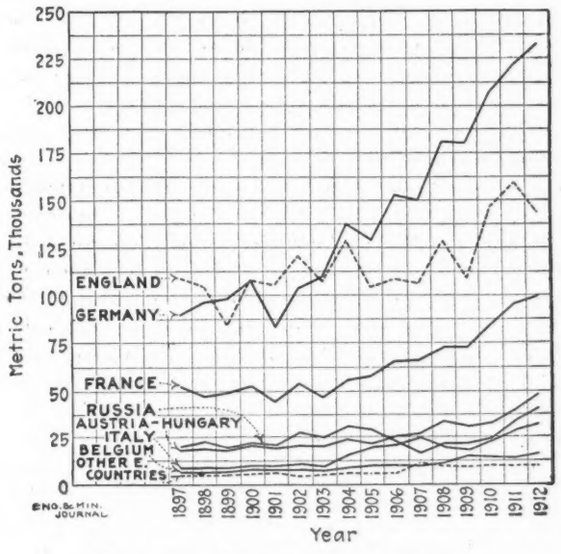
(Metric Tons)

	Germany	England	France	Austria-Hungary	Russia	Italy	Belgium	Other European Countries
1897	89,800	109,600	51,400	17,200	19,400	7,800	6,200	4,400
1898	97,000	104,100	48,800	18,600	21,800	7,800	5,800	4,100
1899	97,700	85,600	49,900	17,100	18,700	7,700	5,500	4,400
1900	108,900	108,500	51,600	19,700	20,400	8,300	6,300	4,500
1901	84,800	105,200	45,100	18,400	19,000	9,400	6,500	5,100
1902	102,000	120,000	53,400	19,400	26,300	10,700	6,700	3,400
1903	110,100	107,600	48,600	18,900	25,000	9,600	6,100	4,400
1904	136,300	127,900	56,600	23,200	31,200	14,900	7,800	5,000
1905	128,000	103,300	57,800	22,700	27,600	17,200	8,600	5,000
1906	151,100	107,600	64,100	24,700	23,500	19,800	9,000	5,000
1907	150,000	106,100	65,300	26,600	17,600	25,800	9,500	10,700
1908	180,800	127,600	73,700	33,500	20,900	22,300	11,000	10,700
1909	179,400	108,300	73,400	31,100	21,600	17,000	13,000	8,800
1910	209,400	146,000	85,700	33,500	28,600	22,500	13,000	11,400
1911	222,100	159,100	95,700	38,500	32,800	29,400	13,500	11,000
1912	232,700	144,700	99,800	48,200	40,000	33,600	15,000	11,000

For the last five years consumption has increased at the rate of 6.5% in 1908; 11.5% in 1909; 16% in 1910; 4.4% in 1911 and 9.05% in 1912. In fact, since 1907

there has been an increase for each succeeding year, and going back over the 16-year period only three years have registered a decrease over the preceding year. Two noticeable and important facts may be seen on the chart of the world's consumption of copper; first, that the United states and Europe are practically the consumers of copper; second, the American and European consumptions are by no means parallel in movements. In Europe, Germany and England are the consumers of copper in the order named and France is third. The rest of Europe consumes about as much as England.

This enormous increase in the use of copper is undoubtedly due mainly to the development of electrical appli-



EUROPEAN COPPER CONSUMPTION

ances. But the real base of the movement goes beyond this; we are passing through the age of machinery and the period of substitution of metal for wood and other materials. Communication, transportation, manufacturing and farming are rapidly changing from man and horse labor to mechanical methods in every part of the world. Even a great part of our household duties are now performed by machines. It is needless to point out this development, for there is not one of us who has not seen this evolution going on. Today we are not surprised to see machines built to perform any kind of work even better than it is possible to do it by hand. It is true this advance has gone pretty far in the principal countries of the world; covering Europe and the United States and parts of other countries, but there is a greater field ahead than has been covered. Some general statistics on the increase of electrical apparatus show that the manufacturing of dynamos, generators, etc., increased 730% in the United States from 1899 to 1909; transformers, 197%; switchboards, 223%; motors, 64%; storage batteries, etc., 188%, and telegraph instruments, 19%. The value of incandescent lamps increased 342%, and lighting fixtures, 243%. Practically all this output of equipment has been consumed at home and in countries where the development of mechanical arts is as advanced as ours. The population of the world being about 1,522,000,000 people, we are then using 1.5 lb. of copper per capita. But carry this further and we see how unevenly this consumption is distributed. Europe is apparently using about 3.6 lb. per capita per annum; America, 5 lb.; while Africa, Australia, and Asia combined use only about 0.09 lb. per capita.

FUTURE CONSUMPTION

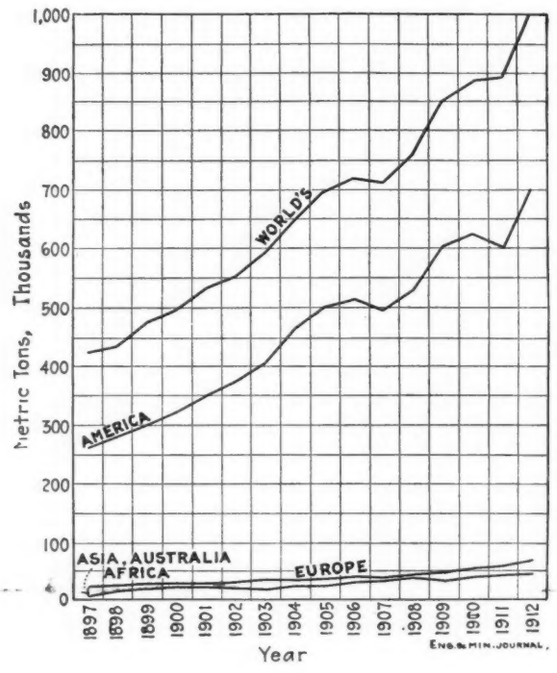
The world moves faster today than ever. When new territory is opened up it requires only a short time to introduce the most modern methods and machines. Take for example middle and western Canada. As soon as possible the farmer equips his farm with modern machinery, and we find him a consumer of metal quite in proportion to his brother in the fully developed districts of the United States. Or, as another instance, the mining camps of southern Nevada. Within four years after the discovery of Tonopah and Goldfield, situated in the heart of a desert, the inhabitants were enjoying all the comforts of modern conveniences quite in proportion to those of large cities. These are cited to show what may be expected in the way of increased consumption in any country not now fully developed in the use of modern machinery and appliances.

In Argentina this development has been going on much faster than most of us have realized. Brazil also is fast taking its place among the first countries of the world. American capital is now turning to Chile and Peru for the development of mines on a scale equal to the operations now conducted at any of our own. Good governments have been established in what we once thought were hotbeds of revolution, so today we are undoubtedly seeing the turning point in the temperate zones of South America at least, if not in a part of the tropics. In Japan the growth has been wonderful and in China the signs of an awakening of the people was evidenced by a radical change of government, which may mean the forerunner of a great industrial improvement.

When Asia with its 850,000,000 people reaches the point where it consumes one-fifth the amount of copper per capita of the United States its consumption will be about 30,000,000 lb. more than ours is today. Using the average for the world it would be consuming nearly 1,300,000,000 lb. per annum. It would take less than half the consumption per capita of the United States to bring the South American consumption up to the present consumption of Africa, Asia and Australia. It is easy to contemplate the future need of copper when we stop to consider how little is needed to bring these countries to where their total annual consumption is equal to ours. In 1912 I had occasion to make a rough estimate of the future consumption of copper and calculated that the world should be using about 3,000,000,000 lb. by 1921. In the ENGINEERING AND MINING JOURNAL, Apr. 12, 1913, on p. 742, may be found an estimate of a little over 3,500,000,000 lb. consumption for 1920. The method used to arrive at this figure is fully explained in the article. My estimate was made on about the same line of reasoning. If new fields are to be opened for consumption by the improvement of methods and development of resources in the countries mentioned, it does not seem at all unlikely that we will need this much copper within the next decade. Beyond that, should we look for any cessation in the use of copper? Certainly not until every country has reached its maximum industrial growth and we are all using the same materials and doing things by methods subject to no further improvement.

Future Supply of Copper

The absorbing and unanswerable question suggested by this discussion, granting we will need 3,500,000,000 lb. of copper annually by 1921 is, Where will it come from? The table and chart of the world's smelter production of raw copper shows we will need an additional 1,350,000,000 lb. by 1921. It shows that about 70% of the present copper supply is coming from America and fully 95% of this 70% is from North American ores. Europe, the next in rank of copper producers, gives a little less than 19.5% of the world's supply. In the "Cost of Copper"



World's Copper Production

it was shown that fully 72% of the North American copper came from about 30 mines. As stated then, it is doubtful if any of these mines, except those not fully developed and equipped, can materially increase its output, being necessarily limited by economic conditions. We certainly cannot add anything to the Lake Superior group's output. It would be surprising if the district does not show a decline of at least 25,000,000 lb. by 1921. The present operators of the porphyry group may somewhat increase their outputs. But allowing liberal increases

WORLD'S SMELTER PRODUCTION OF RAW COPPER
(Metric Tons)

	Europe	America	Asia	Australia	Africa	World's
1897	124,800	262,600	20,400	12,400	.....	420,200
1898	121,300	280,500	21,000	15,600	.....	438,400
1899	134,500	300,900	24,300	19,200	.....	478,900
1900	132,000	321,400	24,300	21,800	.....	499,500
1901	134,600	351,300	27,300	22,000	.....	535,200
1902	127,900	376,400	29,000	20,000	.....	553,300
1903	136,100	402,500	33,200	19,500	.....	591,300
1904	129,700	463,400	32,100	22,700	.....	647,900
1905	132,100	504,200	33,700	23,900	.....	693,900
1906	139,800	512,800	38,500	29,500	.....	720,600
1907	144,900	498,200	36,400	32,500	.....	712,000
1908	151,900	530,000	41,400	34,500	.....	757,800
1909	156,200	616,400	45,500	31,100	.....	849,200
1910	175,700	623,200	50,100	37,900	1,000	887,900
1911	181,500	614,900	55,000	40,000	2,000	893,400
1912	197,000	707,900	67,000	44,900	3,000	1,019,800

for all, including the new properties under development, we cannot safely count on them to supply an additional 200,000,000 lb. annually in eight years. Going over the miscellaneous mines in North America it is hard to see where there will be an increase in production that will much more than offset the decline of some. It seems to be stretching the point to say that we may expect the United States to furnish an additional 250,000,000 lb. annually from known sources.

Although the demand for copper has made such rapid strides Europe has shown only a slight increase in production. If Russia is to bring more copper into the market the new supply can only be obtained after proper development and equipment of these new mines. Siberia is reported to contain some good copper deposits and Australia and Africa can also furnish additional supplies in time. Alaska is also a field of some promise, and Canada will probably bring some more copper into the market. In Chile and Peru preparations are now being made that will bring several million pounds on the market in a few years and we might be able to get 200,000,000 lb. more per annum from them within eight or 10 years. But the serious phase of the question is this: We are contemplating an additional increase of at least 1,000,000,000 lb. of copper within eight years, an amount almost equal to our present North American mines' output, the production of which is yet to be provided for. When we stop to think that some of this will surely have to come through the discovery of new fields, that miles of railroads must be built to reach some deposits, and that it takes about five years to bring a fair producer up to its maximum, we can easily see what the situation may be if we actually need this increase in production.

A production of 250,000,000 lb. annually means a group of mines equal to the porphyries in 1912, more than the present Lake Superior district, and practically equal to another Anaconda. But notwithstanding this let us assume that two such fields may be developed and brought to the producing stage within the next 10 years, we will have only provided for one-third of the expected increase in consumption. Even if the increase is much less, the situation is still quite a problem. There is evidence that certain large copper interests are convinced of the probable shortage and are already taking such steps as possible to meet it. There may be short periods of cessation in increase of consumption, but a demand has been created for copper and other metals and the cause is certainly deeper than any temporary boom or wave of industrial activity.

If there is any truth in this analogy the only relief will come from the discovery of new fields, full development of known deposits or maybe some revolution in the treatment of ores. If more of our copper is to come from our small deposits, heretofore unprofitable, there is good argument for higher prices for the metal than in the past. It may be that the greatest danger ahead will be a movable surplus so small that it may easily be cornered by speculators.

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The Energite Explosives Co., whose plant was destroyed by an explosion a year ago, resulting in the loss of six lives, has been recently sued and one of the plaintiffs, a widow was awarded $3700. The cost of the case will be borne by the defendants. Other cases against the company are pending. The jury found that the company was negligent in not having the crushing room properly isolated from the mixing and finishing room, in not having confined the dangerous operation of crushing chlorate of sodium within properly constructed fireproof walls, and in permitting an unnecessarily large quantity of finished product to be stored in the finishing room where several employees were engaged.

Notes on Lake Champlain Iron Mines

By L. O. Kellogg*

SYNOPSIS—Detached observations on the magnetic deposits and the methods of working in the eastern Adirondack region. Possibilities of the district are great. Magnetic concentration highly developed. Uses of tailings. Excellent power plants and surface works. Mining methods less advanced. Curious survivals in hoisting practice. Labor is inferior. Costs low and continued operation in the face of rather hard conditions indicates good management.

Four iron-mining companies are at present operating in the Adirondack region in northeastern New York, bordering on Lake Champlain. They are the Chateaugay Ore & Iron Co., at Lyon Mountain, owned by the Delaware & Hudson R.R.; the Port Henry Iron Ore Co. and Witherbee, Sherman & Co., Inc., at Mineville; and the Cheever Iron Ore Co., near Port Henry. Most of the product of these mines is shipped some distance, usually after concentration. A certain amount of the Mineville concentrate, however, is smelted in a furnace at Port Henry and the entire product of the Chateaugay company is handled by Standish furnace a few miles away. Both these furnaces are operated by the Northern Iron Co. Standish furnace was operated on charcoal for many years up to 1904, as the lack of forest on the surrounding hills bears witness.

Extensive Reserves

The magnitude of the deposits of magnetite in this part of the Adirondacks, as well as in other parts, not to mention the New York and New Jersey Highlands, is not popularly realized. Measured in tons they are quite capable of comparison with the reserves of the Lake Superior ranges and of Alabama, and constitute an important item in our iron resources. Especially in the Adirondack region under discussion are there deposits of enormous extent, and drilling operations in the last few years have served to extend considerably the limits of the orebodies. Speaking broadly, the unit here seems to be a hundred million tons; of these units, the Chateaugay Ore & Iron Co., at Lyon Mountain, is said to have five and, according to report, Witherbee, Sherman & Co., Inc., are credited by one geologist with two at Mineville and two in the country near Arnold Hill. These figures are not official, nor are they complete, but they indicate the magnitude of future developments in this district, taking no account of the magnetites in the New York Highlands, the New Jersey Highlands, and other parts of the Adirondacks.

Such estimates do not represent ore blocked out, as in copper or gold mining. They are based rather on a few drill holes, the results from which are interpreted in the light of geological study and data from past mining operations. A fair amount of knowledge can be had with surprisingly few holes. Experience has shown that the magnetite beds are unusually persistent, even though in some cases erratic, and there is a little likelihood that the tonnage is overestimated. It is not attempted to develop extensively by underground workings and this seems wise, as the additional information gained would hardly make up for the expense involved. Work is conducted on a narrow margin and capital expenditures are reluctantly made.

It is evident that with resources such as this, to which may be added the titaniferous ores and the Clinton hematites, while the Central Atlantic states may never again regain control of the iron industry, they will, nevertheless, increase in relative importance up to a certain point and become a strong factor in the industry.

Concentration and Utilization of Tailings

Material running 28% in available iron is considered ore, although much of the magnetite is of shipping grade, beating 60% iron. Evidently the ores require concentration before use in a furnace and the accepted method of performing this is with magnetic machines. Magnetic concentration has been brought to a high stage of development and remarkable results are obtained. The effect of concentration is twofold: to increase the iron content and to decrease the phosphorus. The Witherbee-Sherman company, in particular, has done pioneer work and has gone far in the development of iron magnetic concentration, and may be considered quite the leader in that branch of metallurgy.

What may be termed the utilization of byproducts is an interesting feature of practice. Thus the Chateaugay company ships practically all of its tailings during the summer months. They are used for road surfacing, for railroad ballasting and for concrete work, especially in sidewalks. A large part of northeastern New York is paved and ballasted with Lyon Mountain tailings. No charge is made for this material, but the Delaware & Hudson, which owns the mines, gets its return in freight charges. Witherbee, Sherman & Co. is not fortunate so to control freights as to make it profitable to ship its tailings to any great extent. An appreciable amount, however, is absorbed in making concrete. The company uses concrete wherever possible, with excellent results in the line of appearance and permanency. In addition to this use some of the high-phosphorous tailings from the Old Beds are reconcentrated, the iron minerals being lifted out with Wetherill machines, leaving an apatite-silica mixture righ enough in phosphorous to be marketable as raw fertilizer material.

Good Surface Plants

The surface plants in general, except for the hoisting, are comparable with the mills in excellence. The Chateaugay company has an excellent power house, although it is not operated to capacity; the Cheever company has also a good electrically compressed air converter station; the Witherbee-Sherman generating station on Lake Champlain is a model and the central power house in Mineville as well as the compressor house, are above the general run of mine plants. This company pays great attention to its power department, with good results.

Gratuitous criticism by a stranger, of mining practice in any district, is usually unwise. It is exceeding diffi-

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cult to grasp the situation without long experience, nevertheless I may hazard the remark that the underground methods of the region are not up to the standard of the surface plants and that the hoisting practice shows some curious survivals from past ages. It must be admitted that there are conditions, evident even to an outsider, accounting for many of the peculiar methods followed. It is exceedingly difficult, for instance, to plan a systematic mining method when the shape of the orebody is not known until it is mined out. Again, at the Barton Hill deposit in Mineville and more especially at Cheever, the foot wall rolls both ways so as to give a doubly corrugated surface. The effect of this condition on the mucking and tramming is evident. The flat deposit at Cheever with its rough bottom offers about as mean a problem as the miner has to solve, short of bad ground. It does seem, however, as if some mining method could be devised at the various properties which would eliminate the extravagant, two-man piston drill.

A great fear of dead work in the past has produced curious shaped openings and operated against the economical handling of material underground. The golden rule of following the ore was observed to the letter. The Bonanza shaft of Witherbee-Sherman starts as a sober-minded, vertical shaft, turns to an incline and again to a vertical. This is a turned-vertical shaft with a vengeance! It is not the intention of Witherbee-Sherman, however, to continue using this shaft to any great extent. In fact, stage hoisting is to be substituted for turned-vertical shafts in most of this company's mines.

Unusual Features of Hoisting Practice

The use of a great number of drums on one shaft, the guiding of the hoisting rope with turn sheaves and pulley stands, and the failure to hoist in balance, are curious variations from common hoisting practice which may probably be attributed to the isolated development of the region. Multiple-drum hoisting is about to disappear. At one time at Lyon Mountain, there were eight drums on one shaft and six on another. The Port Henry Iron Ore Co. also had a six-drum hoist. The shafts of these hoists were driven practically all the time by relatively small engines, and each drum at Lyon Mountain at least, had its clutch and brake manipulated by long wooden levers. An engineer ran the engine and there was a brakeman for each drum. With eight drums spinning, such a shaft house must have been a busy spot. This was an interesting method of approximating a uniform load, but it seems not to have survived the stress of competition with other systems. Each cable from the shaft house was carried out through a narrow slot and around a turn sheave to a direction parallel to the strike of the deposit, then over a series of pulley stands to a point opposite its shaft or slope, around another turn sheave, and over the small headframe. The rows of pulley stands along the foot wall of the outcrop can still frequently be seen standing.

At present the only thing of this nature is the hoist serving "A" and "B" shafts of the Witherbee-Sherman Harmony mine, in which a single motor is used to drive the four drums, mounted, however, on two shafts parallel to the motor shaft. Two of these drums are to be taken off before long and the activities of the hoist confined to one shaft and headframe.

The necessity of utilizing old openings and surface structures probably makes it impossible to do away with the turn sheaves or to hoist in balance in all cases. It must not be supposed, however, that hoisting in balance is entirely neglected. The Joker haft of Witherbee-Sherman is equipped with an excellent hoist for balance hoisting, and the Port Henry company, as well as the Chateaugay company at its No. 4 shaft, uses this method.

An interesting variant from ordinary hoisting methods is found in the opencuts of the Chateaugay company, where derricks are used, mounted on the edges of the cuts, the sides of the cuts being approximately vertical. The broken ore is loaded into typical quarry boxes, i.e., low wooden boxes with one end open. These are lifted by the derrick and swung to position over the awaiting ore car and then dumped by letting drop the open end.

Multiplicity of Turn Sheaves

The turn sheave is an excellent device for overcoming topographic conditions unfavorable to simple relations between hoist and shaft. It is all right in its place, but in northern New York it seems to have become an obsession. The use of two turn sheaves on one cable, except under extraordinary conditions, is carrying matters too far. It is self-evident that the power consumed in bending the rope around two sheaves additional to the one on the headframe and in revolving these sheaves with possibly a line of guide sheaves on pulley stands, is far from negligible; furthermore, the first cost of the additional sheaves installed is a considerable item and the wear on the ropes is theoretically nearly doubled.

Foreign Labor Exclusively

The quality of labor over the region in general leaves much to be desired; Hungarians, Poles, other Slavs and Italians make up the greater part of the miners and muckers. There is little English spoken or understood by the men and rules have to be printed in several languages. Wages are low compared with the West, or even with Lake Superior, and the men are probably worth just what they are paid, or a little less. At Lyon Mountain the Poles predominate and are looked upon favorably by the management. It must be stated that they are a fine husky lot of men to see. Italians here are said not to have proved satisfactory underground, being nervous in the face of the apparently dangerous conditions. At Cheever also, the Poles are esteemed. At Mineville, however, they are avoided, as being trouble makers; the Hungarians here are considered most satisfactory. The Witherbee-Sherman company also has a warm place in its heart for its Italians, who proved unusually loyal during recent strike troubles. This loyalty sprang in part from hatred of the Poles, who were the striking element. It is noteworthy that the Finns and the Poles, two races that have received a crooked deal in Europe, seem determined to even things up in America by starting something whenever possible.

No Candles Underground

Illumination methods in these iron mines differ from general practice in the Western camps. The candle is practically never seen and the choice lies between an open-wick lamp burning kerosene, sunshine, or some other hydro-carbon, and the acetylene lamp. There is no question about which is preferable; the acetylene

light, in spite of the many defects of the lamp itself, is far superior to the smoky, red flame from an open wick. The kerosene lamps used by the machine men at Lyon Mountain are as large as small dinner buckets, and make a tremendous smoke. The fact that the men work in rather large groups, removes one of the main objections to the acetylene lamp. In case of a fall or a stoppage, there is always a light handy by the aid of which repairs can be made. The black material of the walls so absorbs the light as to make candles quite ineffective, it is stated.

Cost Considerations

It should be noted in magnetite mining, as well as in the mining of other ores in which the valuable constituent is heavy, that costs per ton are not a fair criterion. Costs per unit of volume such as a cubic yard would be a much fairer basis for comparing results. It is self-evident that it need cost no more to break a cubic yard of 60% ore than a cubic yard of 30%, but a much greater tonnage would result in the first case. In mucking and hoisting, of course, the heavier cubic yard costs slightly more to handle than the lighter one, but not at all in proportion to its specific gravity. Any mucker would prefer to shovel a ton of gold, rather than a ton of snow, even without considering the possibility of personal enrichment. The result of a comparison on a ton basis of the costs of different properties is to penalize the low-grade mine, where a larger bulk of material must be handled to obtain a given tonnage.

While total and itemized costs per ton are not obtainable from the various mines, their continued operation indicates that a profit is being made in most cases and the ability to make a profit in the face of existing conditions indicates good management as a whole. Mining conditions are only average, and the deposits are in general of low grade. To break and hoist the ore, to concentrate in some cases in as high a ratio as 3:1, to dispose of a product rather undesirable in many ways and to show a final profit, shows good mining, close work, and low costs.

French Iron Production in 1913

Pig-iron production in France for the half-year ended June 30 is reported by the Ministry of Public Works at 2,374,583 metric tons in 1912, and 2,618,420 in 1913; an increase of 243,837 tons. The production this year included 438,340 tons foundry; 268,098 tons forge; 86,544 tons bessemer; 1,784,822 tons basic, and 40,616 tons ferromanganese, spiegeleisen and other ferroalloys.

Steel

The production of steel ingots and direct castings for the half-year was as follows:

	1912	1913	Changes
Acid converter	56,398	65,308	I. 8,910
Basic converter	1,355,138	1,501,125	I. 145,987
Openhearth	685,215	758,659	I. 73,444
Crucible and electric	18,040	15,918	D. 2,122
Total	2,114,791	2,341,010	I. 226,219

The production of finished iron and steel for the first half of 1913, as reported by the Comité des Forges, was 1,568,722 tons, an increase of 96,039 tons over 1912. The heavier items were 522,813 tons of bars and shapes, 298,013 sheets and plates, 261,908 structural steel and 235,859 tons of rails.

Deep Shaft Development at Placerville, California

By Lewis H. Eddy*

The Pacific shaft of the Placerville Gold Mining Co., at Placerville, Eldorado County, Calif., has been deepened from the 1000-ft. level to the 1600-ft. point in the past seven months, and will be continued to the 2000-ft. point before new crosscutting or drifting is started. This is not record drilling. But the method of development is in the line of advancement adopted in other similar undertakings of reopening old mines in the Mother Lode region in the past year. This property had been worked for several years with the apparent idea of developing a mine at shallow depth. A vertical shaft was sunk to 700 ft. From this point a crosscut was run 140 ft. east. The shaft was then deepened by a winze to 1000 ft., following the dip of the formation which is about 70 deg. east. A drift 180 ft. was run from the winze to the north along the strike of the formation.

That was the extent of the development at the time of my first visit to the property in September, 1912. The physical features disclosed were interesting from their similarity to disclosures in developed mines in other districts to the south in the Mother Lode region. The situation is in the footwall slates on the western edge of the Central Belt of the Mother Lode, at an elevation of 2000 ft. at the collar of the shaft. This elevation is about 5000 ft. higher than the mines in Amador, Calaveras and Tuolumne Counties. The company, of which Alexander Baring, of London, is president, has a large amount of mining property adjacent and in this vicinity and it was determined to reopen this property and prospect it. A. E. May, who had been in charge of operations of the Barings in Mexico, was made manager. Mr. May pumped out the shaft, made an examination of the physical features and visited some of the producing mines in Amador County and then decided to go down deep enough to provide prospecting ground sufficient to enable him to determine by careful development whether or not the same geological formation and physical conditions in Eldorado County as occur in other Mother Lode counties, will make a producing mine.

An accident which occurred in the initial stage of the work of pumping out the mine is of peculiar interest as it indicates the possibilities of accident and the necessity of care in pumping old workings of an abandoned quartz mine. The following details of this accident were given me in August, 1913, by Mr. May, from the note which he made at the time of the accident:

On Aug. 31, 1912, we commenced to pump out the winze on the 700-ft. level of the Pacific mine. "A" was one of the men employed to care for the pump, in oiling and lowering the same. On Sept. 29, 1912, the water in this winze had been pumped out, so that the floor of the 1000-ft. drift was uncovered, and a man could enter the old level, which extended about 180 ft. from the winze to the north. At 5:30 a.m., "B," who was on shift caring for the pump at this hour, made a trip from the winze into the face of the old level. Again at 6 a.m. "B" repeated the trip, going in to the face of the old 1000-ft. level. At 7 a.m., "A" came on shift to relieve "B." "A" made a trip to the face of the old 1000-ft. level and returned to the pump, then climbed out of the winze up to the 700-ft. level. Later he returned to the bottom of the winze and went into the drift again. When about 50 ft. from the mouth of the level and at the foot of an old raise

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that had been put up about 30 ft., an explosion of gas occured, which burned "A's" face and neck, singed his hair, and burned his hands most painfully. He picked himself up after the explosion, lighted his candle, climbed the 300 ft. of ladders to the 700-ft. level, and was then hoisted to the surface.

Mr. May said that he had all the time been prepared for bad air in the nature of carbon dioxide and kept candles burning at the points in the winze to give warning, but had never anticipated encountering marsh gas, which he thought was probably the cause of the explosion. The force of the explosion was considerable as the top of the winze at the 700-ft. level was covered with 3-in. plank and these were blown off. There were a few pieces of old timber in the top of the raise where the explosion occured, and the gas may have resulted from these, as they had been there under water for about 30 years. The man's hands are not well yet.

The deepening of the shaft was started in the last of December, 1912. In the first five months the drillers averaged 80 ft. per month. In July they sank 96 ft. and in August, 109 ft. Mr. May stated in August, that he expected to average 100 ft. per month in the succeeding four months and complete the shaft down to the 2000-ft. point by the end of the year. There has been no effort at record drilling. The old hoisting equipment, which is being used for this preliminary work, is not adapted to rapid hoisting. The surface hoist is air driven. The underground hoist at the 700-ft. station is an old steam hoist that was used in the '80s. It has been overhauled and is now air-driven. These hoists are adequate to the purpose of sinking a prospect shaft. The drills are Ingersoll-Rand class C-110 and are doing good work. It was decided at the beginning that the matter of new equipment would be deferred until the development proves whether or not there is a prospect of making a mine. The indications down to the 1600-ft. point are favorable to the continuation of the shaft.

The shaft is sunk in the black and gray slates in the foot-wall side of the lode, following the formation in its dip to the east and disclosing strong quartz all the way down to the 1200-ft. point. In some places this quartz is 25 ft. wide with fine greenstone foot and hanging wall. There are several faults below the 1000-ft. point, and between the 1000- and 1100-ft. point the quartz dips back toward the vertical. The shaft was continued with the formation, and below the 1100-ft. point the quartz came in again. It was followed, dipping generally with the formation, to the 1200-ft. point where it pinched out. The laminated rocks stand fairly vertical, and the faulting of the quartz and dipping back to the west is a probable indication that the vein series at 2000 ft. or below that point will be found to be generally nearer to vertical than the 70 deg. dip of the slate formation followed by the shaft.

The sinking of this shaft and the crosscutting and drifting that is contemplated, whether or not it proves a mine of commercial value to the owners of the property, will be of incalculable benefit to the owners of mining claims on the Central Belt of the Mother Lode in Eldorado County. Deep prospecting is essential to the future development of quartz mines in this region, and there are few of the holders of claims, which extend along the lode for a distance of 20 miles in an almost continuous chain, who are financially equipped for deep shaft sinking and exploration. The Mother Lode formation extends in a general northwesterly direction entirely across the county, and the Placerville district is the most favorable point for deep prospecting. The general formation in the Placerville district is of serpentine on the east or hanging-wall side and black slates on the west or foot-wall side. In the southern part of the district the black slates are flanked on the west by granitic rocks, and in the northern part diabase follows the slates along their western edge.

The Use of Lead in the Tropics

By W. H. Mawdsley*

For many purposes, such as roofs and gutters, where exposed to smelter fumes, sheet lead would at first sight seem eminently suitable. Under a tropical sun, however, it becomes soft, expands and finally creeps. This action appears to go on indefinitely without a corresponding contraction, until eventually it becomes buckled and cracks. When used for gutters, it proved unsatisfactory and had to be replaced by cement reinforced with wire netting.

When used for lining wooden tanks to contain hot acid, the same trouble from creeping and buckling occurred; where the tanks were 5 ft. deep or more, I found it advisable to burn straps on the lead about half way down, take these through an opening left in the woodwork and make them fast to a rail around the outside of the tank. This relieved the strain upon the top and prevented the creeping. The corners of rectangular tanks seemed to become crystalline and finally porous, and I found that by burning a vertical piece about four inches wide from top to bottom in each corner, it stiffened the lead and made it last much longer.

It is a mistake to have the bottom boards of a lead-lined tank nailed down, as the nails often work partly out and damage the lead; there is the advantage, too, that should a board need replacing, it can often be done without disturbing the lead. With the vertical lead pipe used for raising acid to the top of the towers, I found the "wiped" joints most satisfactory, especially when the pipes were burned together before being "wiped." The protuberance formed by the solder was convenient for supporting the pipe by a wooden clip, and sometimes a ring of solder was put around the pipe in other places for the purpose of supporting it. Where the pipe was flanged and connected by iron washers, the root of the flange seemed often to crack and then leak. Burning a strip of lead to the pipe and nailing it to timber did not prove satisfactory, as the lead invariably stretched. It was also advisable to case the pipe with easily removable timber to prevent it bending between the brackets.

When a pipe is laid horizontally for any considerable distance, it should be supported on timber, and side pieces fixed on the carrier at intervals to prevent the pipe projecting at either side. An expansion loop should also be provided, care being taken that the upper part of the pipe does not come in contact with the lower. When pipes are buried, the expansion loop is not so necessary as the variations of temperature underground are not so great.

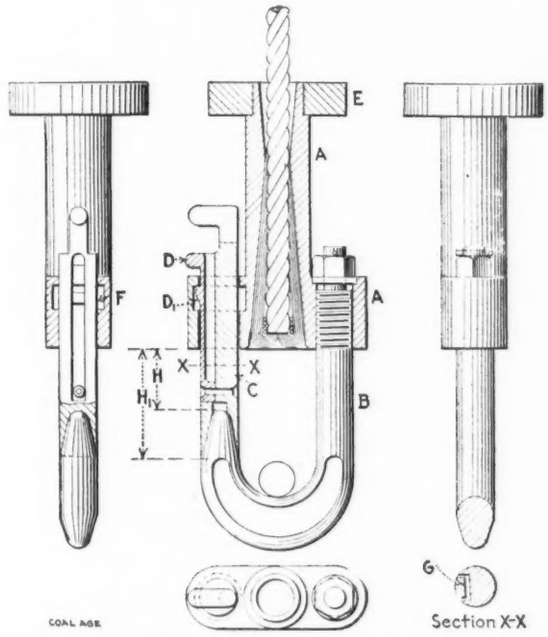
*Mt. Morgan, Australia.

The Sanitary Advantages of Sand Filling of Stopes are only secondary to its function of supporting the back. This is pointed out in the "Journal" of the South African Institution of Engineers, September, 1913. The unfilled stopes on the Rand interfere with ventilation and are open to the irresponsible Kaffirs who pay no heed to hygiene. By filling with sand the worked-out areas, the health of the men underground is promoted.

DETAILS OF PRACTICAL MINING

Safety Hook for Sinking Buckets

A new safety hook for sinking buckets in connection with a cable clamp has been devised by an engineer at the Myslowitz colliery, in the North Kattowitz mining district of Germany and has been used there with success. It is described in the "Zeitschrift für das Berg-Hütten- und Salinenwesen." It consists of the following principal parts: (1) The cable sleeve A with flange A_1 forged from the same piece; (2) the bucket hook B;



Detail Construction of the Safety Hook

(3) the lock bolt C; (4) the lock spring D welded on lug D_1; (5) the flange E.

The cable clamp is bored out conically for receiving and fastening the rope. In the flange A_1 are held the bucket hook B and the lock bolt C which together form a closed shackle, the hook B being screwed into the flange A_1 and further secured with a keyed jam nut, while the lock bolt C is loosely passed through its hole in the flange.

The lock bolt C is made of an iron bar cut or forged away at the upper part and is formed at the top as a handle for easy manipulation. At the lower end it is bored out conically to receive the point of the bucket hook. It is provided lengthwise with the groove G in which is set and riveted the lock spring D. The safety hook is closed in the illustrated position and, by the lock spring D, upon which the lug D_1 engaging in the cavity F, prevents self release of the lock bolt C and thus an unhooking of the bucket suspended from the hook B even when the bucket is let down to the bottom of the shaft and the rope is slackened.

In order to let the bucket be hooked to and unhooked from the hoisting cable, the workman must press back the lock spring D and raise the bolt C, which opens the bucket hook. As soon as the bolt is let go, it falls back by its own weight and again the lock spring D closes the lock bolt C by an engagement of the lock-spring lug D_1 in the cavity F. The flange E screwed on the rope sleeve prevents the bolt C from being lifted so high as to drop out when opening the hook.

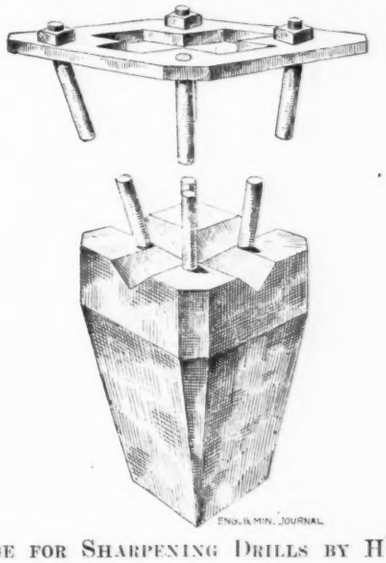
The manipulation of this safety hook is easy and simple. It is automatic and reliable. In making the hook care is taken that the upward movement allowed for the lock bolt bears a correct proportion to H and H_1.

Sharpening Machine-Steel by Hand

By Emory M. Marshall*

For sharpening machine-steel at a mine where the sharpening is done by hand, the device, designed by S. J. Collins and used by the McConnell Mines Co., is of value.

The ordinary dolly used for sharpening is drilled at the four corners, as shown in the accompanying sketch,



Swage for Sharpening Drills by Hand

and rods of $\frac{7}{16}$-in. iron are screwed into each hole. The dolly is then mounted in an anvil block or fastened securely to the floor. The rods at the corners may be of any length, say 12 to 18 in. The shortest length of steel that can be sharpened depends upon the length of these rods, so they must be short enough to accommodate the starters. These rods are fastened at the top about 2 in. apart by bolting to a plate of $\frac{1}{8}$-in. iron, which has been cut out at the center to allow the drill to pass through easily.

The method of sharpening is the same as the old method, but instead of holding a dolly on the bit while a helper strikes it with a heavy hammer, the blacksmith

*Mason, Nev.

drops the heated steel between the rods and pounds it up and down on the dolly. The iron rods are set so close to the corners that the steel cannot turn, while the flare at the top allows the steel to work freely. Of course, the blacksmith cannot strike as heavy blows as his helper can with a hammer, but by working the drill steel up and down 12 or 15 times, he can get as good, or a better, bit than he can by having a helper to strike for him, and he can do it in the same or less time. This method enables one man to sharpen drill steel as fast as two by the ordinary method of hand sharpening, and the miners claim the bits are better.

Preservation of Boreholes

Recent events have served to remind mining engineers of the advisability of preserving all boreholes put down for prospecting and other purposes, says the *Iron and Coal Trades Review*. Hitherto most boreholes have been lost through the mining companies or others not being prepared to purchase the contractor's tubing put into the holes; the tubes have been withdrawn by the contractor on completion of boring operations, with the result that the boreholes collapse and are lost. In many cases a probable valuable asset has been thus thrown away for the paltry cost of the tubes—an item of, say, anything from £10 to £100, according to the diameter and depth of the borehole.

A remarkable instance of a preserved borehole being the means of saving life has been experienced in the recent mishap at Egremont, Cumberland, England, where two men employed by the Townhead Mining Co., Ltd., were imprisoned in the workings of one of that firm's mines through an inrush of water completely cutting off exit by the shaft. The men knew of a borehole to the east of the shaft; they made their way to it, and soon got into communication with the officials at the surface, who had also gone to the borehole, some 150 yd. from the shaft, and were able to converse with the imprisoned men. Arrangements were immediately made to send down through the borehole thermos flasks containing hot drinks, food, etc., to say nothing of other comforts in the shape of candles, a watch and such woolen clothes and wraps as could be safely put down a borehole 5 in. in diameter. The borehole was also used for pumping air down to the men. The men were imprisoned 5½ days before the shaft was unwatered and they could be brought to the surface, and the borehole was the means of considerably allaying the fears of the management, to say nothing of the anxious relatives and friends of the entombed men.

Stimulated by this notable example, mining companies and others ought in the future to seriously consider the desirability of preserving all boreholes, even if at the time of boring their use as a means of life saving, etc., may appear remote. Cases have been known where boreholes only partially tubed have remained good for 20 years or more. Apart from their use as a means of saving life, boreholes can be and are being used for water supplies and ventilating purposes; and as holes can be bored of a diameter large enough for a man to be lowered up and down, mining companies may consider making such provision where a second exit by shaft or other means does not exist. Moreover, a borehole of such large diameter might have other uses; it could be utilized for the lowering of all timber required in the workings, a work of magnitude in some metalliferous mines which takes up much valuable time at the drawing shaft. Such a borehole could also be used for conducting electric cables to the workings, thus removing the danger of their presence in the shaft, with the further possibility of reducing the length of cable required. The question will, no doubt, be seriously considered in the future.

A Steel Channel Tie for Mine Tracks

The steel tie is becoming the approved support for the rails in mines, largely because of the economy of space its use affords. It seems, however, that it has a marked adaptability for outside and heading tracks. It is true that it tends to bend when subjected to the heavy straining thrusts of the hoofs of mules or horses, and these thrusts also tend to move the tie from its proper place in the track. These defects are met, states *Engineering News*, however, by the W. H. Coffman tie, because instead of the bearing surface being flat, it is channeled, which increases its strength and by indenting the floor prevents slipping.

It would seem that the saving in ballast is an advantage which would serve with the reduction in the ties

STEEL CHANNEL TIE FOR MINE TRACKS, WITH SPRING CLIP FASTENINGS TO THE RAIL

needed, to pay for their greater cost. Where the floor is hard, the laying of a few steel ties on the bottom of the cut or on the top of the bottom rock will be better than using wood ties and bringing in crushed ballast from outside. The maintenance of ditching with a shallow track is cheaper than with one which is of standard depth, especially where that track has to be kept close to a traveled road, as in a mine heading.

The ties are made of ½-in. steel, and they weigh from 1.75 to 1.90 lb. per running foot. They have already been in use for years.

The tie is shown in the accompanying illustration, which is self-explanatory. The channel is $2 \times \frac{9}{16}$ in., $\frac{3}{16}$ in. thick, and is bent cold to shape in a machine specially designed for the purpose. A form of steel tie used somewhat extensively is made from a flat bar 1½x½ in., weighing 2.55 lb. per ft., but this is not so stiff as the channel of lighter weight. The price for the channels, however, is a little higher than that for the bars. For track of 44-in. gage the channel is 50½ in. long, and the two spring clamps are 6 in. long. Such a tie will weigh 9½ to 10 pounds.

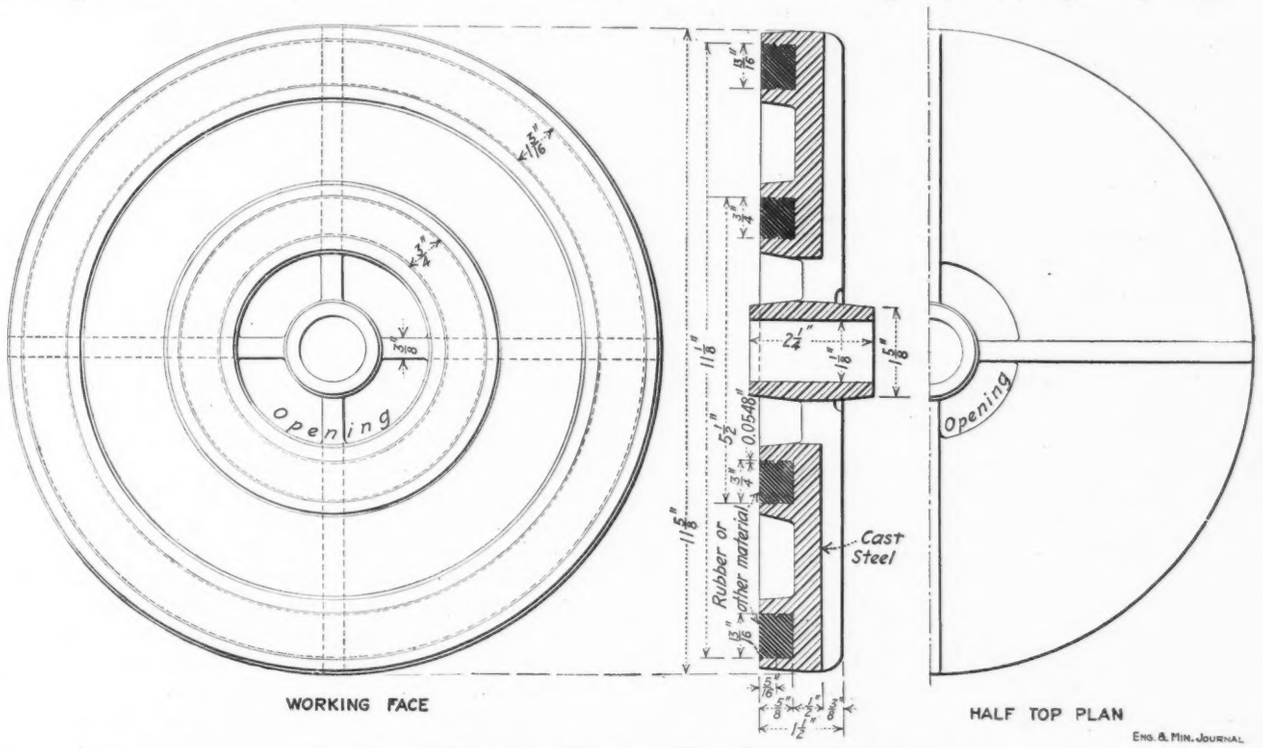
A special advantage of the steel tie is its shallowness

as compared with wood ties, and it is said that this is sufficient to enable 8 or 9% more load to be carried in each car. It also enables the rails to have a bearing on the floor of the mine, so that track will keep in better surface than when the rails are unsupported between the ties.

Under these conditions it is stated that the steel ties may be spaced 5 to 8 ft. apart, especially if the cars are not heavy and are drawn by mules. Some of the steel ties, however, are used on tracks operated by electric motors. Separate short pieces of steel channels, not attached to the rails, may be placed longitudinally under the joints or at intermediate points. These steel channel ties and the bending machine used in their manufacture are the invention of W. H. Coffman, Bluefield, W. Va.

Cast-Steel Pump Valve

A valve designed and patented by J. P. Matthews, of the Rogers-Brown Ore Co., is herewith illustrated. It was found in the operations of this company on the Cuyuna range that the solid rubber valves on the underground pumps were expensive in the first place and required constant changing. The new valve is designed to consist principally of steel; a casting is made as light as possible by being built in skeleton form and reinforced with ribs and two circular grooves are left to receive packing rings of rubber or other available material. The packing soon wears flush with the steel and thereafter wear on the whole valve is much slower. The arrangement obviously saves rubber in the first place and also gives the valve a longer life. It is stated to be eminently satisfactory in service. The valve illustrated is for the smaller type of Prescott pump used by the company; for the larger pump, however, the only change is in the dimensions.



Cast-Steel Skeleton Valve to Hold Rubber Packing

Safety Rules—Employees Underground*

(1) All employees working where there are three 8-hr. shifts or two 12-hr. shifts should positively relieve their outgoing partners at their regular working places; they should talk over the progress of the work and acquaint themselves with the possible dangers before starting work; they shall examine the back and sides and the timbering carefully and correct all apparent dangers on coming to work, on working places and after blasting.

(2) Eight-hour men should leave the change house 15 min. before the hour of going on shift so as to be on duty promptly in their respective working place.

(3) All employees in going on or off shift should proceed directly by the usual or designated route to their respective places and shall not leave such places except on company business.

(4) No employee should travel from one part of the mine to another through any raise, stope or opening, but only by the ladderways and manways expressly reserved and in use for that purpose.

(5) Miners should go after their timber by the designated way, or by the usual way.

(6) Never stand on loose ore over a raise; it may drop at any time and draw one in.

(7) As often as necessary to secure safety, miners shall pick down the back and keep it picked down and secured.

(8) All shafts, drifts and levels in disuse or in disrepair should be at once permanently closed and kept closed. No employee should go or be therein or thereon for any purpose whatever unless engaged in repairs, until until the opening is again in good repair and properly lighted and guarded.

*From Inland Steel Co.'s book of rules.

(9) All openings in use shall be sufficiently and frequently inspected and kept well timbered and in good repair and any employee finding dangerous conditions such as crushing timber, caving ground, unusual water or smoke, should at once report the same to the shift boss or other superior, and take whatever immediate precaution is necessary to insure the safety of the place.

(10 All chambers, backs or roofs should be sufficiently secured and should be inspected by someone or more of the employees using them after each blast and should be examined and sounded as often as necessary and all loose and dangerous rock shall be blasted or barred down and the back picked and kept secured. This rule should have special application to all rooms or places where tools, air, cutoffs, air hose, powder or other supplies are stored or kept by the miners when not in use and should apply generally to such other places as are frequently visited or used by the men in the course of their work.

(11) Tram cars on inclined tracks should be provided with blocks to hold them in position.

(12) When removing blocks from in front of tram cars, do not stand in front of the car, but to one side.

(13) When pushing cars, exercise great care and do not stand in such a position that should the car jump the track, you may get caught between it and the timbers.

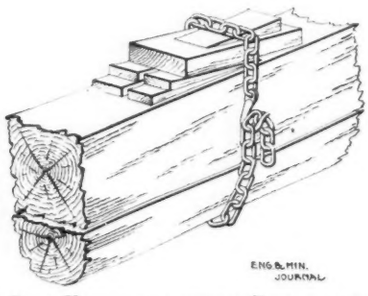
(14) Exercise great care when dumping cars so that the brake does not strike you should the car jump the track.

(15) No pumpman should be allowed to stay alone in a mine after the Saturday-night shift has quit until the mine opens for work on Monday morning or on holidays.

(16) The shift boss or other designated official shall be the last man up at the end of each shift.

Protecting Shaft Timbering against Blasting

The common method in Butte of protecting the bottom set of a shaft against injury by the blasting is with logs.

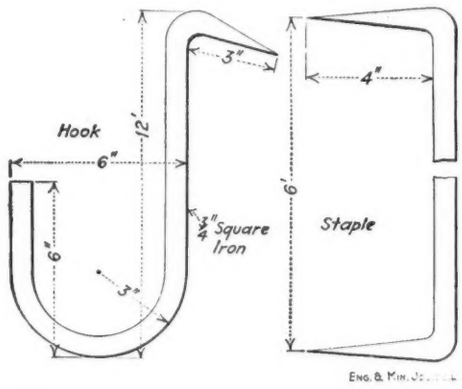


Blasting Log Fastened with Chain and Wedges

Timber 8x12 in. is often used or a 14-in. round stick split lengthwise; in the latter case the round surface tends to throw off the rock ("Bull." A. I. M. E., August, 1913). Such timber may be fastened to the bottom set with either bolts or chains, the last method being shown in the accompanying drawing. The wedges can be loosened easily with a side blow from an ax, and the method is probably the best and most reliable way of holding the logs. In case bolts are used, the head is always placed down. The common size of bolt is 1 in. Instead of logs, ¼-in. iron and 3x3-in. angles are sometimes placed along the edge of the shaft timber, but such pieces are easily twisted out of shape and require frequent straightening by the blacksmith.

Hook and Staple for Staging

In topslicing on the Mesabi, the face of the ore in a room may be as much as 14 ft. high. To reach the top of this for drilling, a staging is necessary. The typical set of timber consists of two posts and a cap, with no studdle the long way of the room. Ordinarily a staging is built on two pieces of logging spiked to the four posts of the two sets nearest the face so as to have the direction that studdles would have. Nails of 30- or 40-penny size are used and are left in either the logging or the posts when the staging is torn down. They are a constant nuisance and source of danger, tearing the clothes and skin of the miners.



Devices Used in Erecting Staging in Top-Slice Sets

Captain James Rosewall, of the Harold mine, an Oliver property, has devised a method of eliminating this trouble. He uses four hooks or hangers of about the design illustrated, driving them into the post and laying in them two rails or poles on which the staging is built. Since there is danger that the set next the face will fall out toward the other and there is no studdle to prevent, 6-ft. staples, also illustrated, are used to drive into each pair of posts in the direction of the studdle. Since a set of this nature will last as long as a mine, it follows that its use is cheaper in the long run than that of nails.

The staple is long enough to span the greatest distance between adjacent sets and is also available for intervals down to 4 ft. by setting it at an inclination. It is found advisable to bend the drive points of the hooks down from a right angle, as shown, since thus there is no tendency for the weight of the staging and men to pull the hook out of the timber. The pieces are shown made of ¾-in. square iron; round iron may also be used; sharp points are rather preferable to chisel edges on the ends.

Hangers and staples somewhat similar to these are common enough underground for many purposes in connection with timbering, but this particular combination seems to be new.

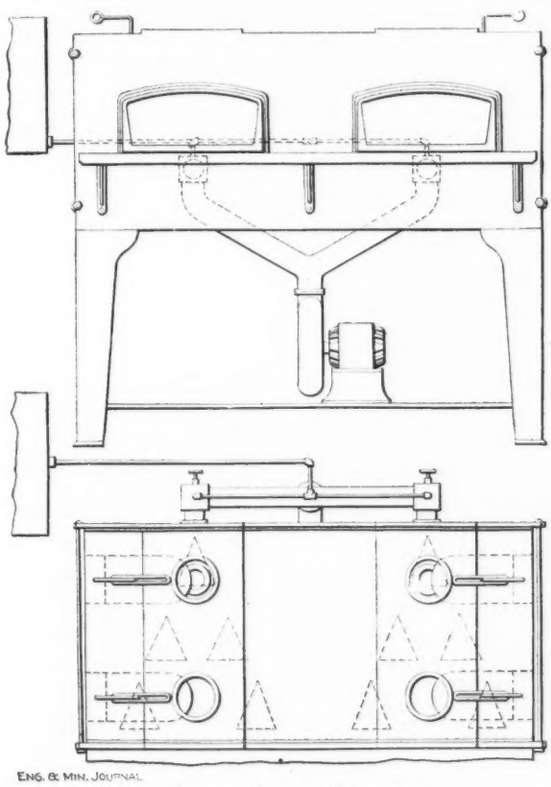
Charcoal as a Precipitant in Cyaniding has been largely used in some places, but has not been considered very satisfactory as it consumes cyanide. Carbon is not the precipitating element, as other forms do not have the same effect. Precipitation is said to be due to carbon monoxide and hydrogen occluded by the charcoal.

DETAILS OF METALLURGICAL PRACTICE

Crude Oil for the Assay Furnace

By W. G. Haldane*

Crude oil has long been used in a desultory fashion as a substitute for solid fuels in many operations, but it is only recently that it has been adopted on a large commercial scale for locomotive as well as stationary engines. Metallurgically, it is being used as a substitute for



Oil-Fired Assay Furnace

long-flamed coals in the roasting of sulphide ores and the smelting of copper ores in reverberatory furnaces, and, while many attempts have been made to apply it to blast-furnace smelting, particularly on copper ores, the results have not been sufficiently gratifying to warrant commercial installations.

The main advantages of liquid over a solid fuel may be summarized as follows: Higher calorific power; smokeless flame (when burned properly); practically no dust or ash; no stoking required, hence less labor; closer temperature regulation; combustion can be started and stopped instantly; economy in storage for equal heating capacity; can be stored a long distance from burners.

The application of crude oil to the assay furnace has been tried repeatedly, but with slight success except in a few isolated and unusual cases, the principal difficulty encountered being in securing proper atomization of the oil at a small cost. The objections incident to the use of steam jets and high-pressure air for spraying the oil into the combustion chamber are manifest and need not be mentioned here.

The United States navy in its various navy yards has entirely done away with the high-pressure fuel-oil burners and uses the low-pressure system throughout (cf. *American Machinist,* Sept. 11, 1913).

I had the opportunity, a short time ago, of conducting a test on a new low-pressure burner, designed by the Denver Fire Clay Co., the results of which may be of interest.

The oil under a head of 6 to 12 in. at the burner is atomized by a blast of air, provided by a 12-in. aluminum blower designed to furnish 4000 cu.ft. per min. through a 2-in. opening and under a pressure of 4 to 5 oz., driven by a ¼-hp. General Electric high-speed induction motor, connected to an ordinary lighting circuit.

The burner can be started with an ordinary match through a small pilot hole at the back of the furnace, the latter also serving to indicate the completeness of the combustion during the operation, and perfect oxidation is easily obtained by simple manipulation of air and oil-supply valves.

The furnace on which the test was made contained two muffles placed side by side, was of special design under the Case patents, each muffle worked independently and each muffle was operated by a burner. This arrangement was so that you could do two classes of work at the same time, in the same furnace, but in different muffles. For instance, you could have a crucible fusing temperature in one muffle and a cupellation temperature in the other muffle. Each muffle was fitted with double-damper arrangement; one damper controlling the atmosphere of the interior of the muffle, and the other, the flame or atmospheric conditions from around the muffle or combustion chamber. The entire furnace was, therefore, under perfect control at all times and excellent work was accomplished.

Thirty minutes after starting the burner, both muffles were ready for work and in 50 min. from the start, 40 fusions were made with a total consumption of 1.6 gal. of crude oil. Cupellation was effected in 35 min. with an oil consumption of 0.9 gallons.

The oil used in this test was Texas crude, selling at 6c. per gal. in barrel lots, but any crude oil, distillate or residue that will flow through a ¼-in. pipe may be used.

The construction of the burner is unique. It requires from 4 to 5 oz. only of air pressure, but great volume. All necessary air for complete combustion goes through the burner proper and is under perfect control by valves fitted thereto; therefore, sufficient air is turned in for the amount of oil, which is also under perfect control, and perfect combustion takes place, thus preventing the formation of carbon and giving the exact temperatures desired within the muffles. Furthermore, with the use of these burners, the muffles are absolutely free of the non-

*Acting president, Colorado School of Mines, Golden, Colo.

conducting glaze, so characteristic of muffles used in coal-fired furnaces.

Owing to the simplicity of an outfit of this sort, the cleanliness, the rapidity and accuracy with which the work is accomplished, equipments of this sort should appeal to the metallurgical chemist.

Aside from its application to this muffle type of furnace, the burner should offer an attractive inducement to the operators of crucible furnaces for the melting of cyanide precipitates and bullion, also its application in connection with melting furnaces in brass foundries.

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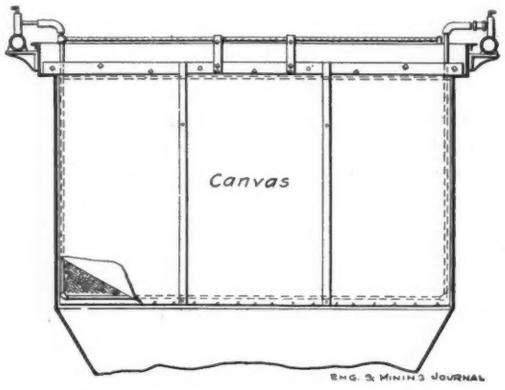
Vacuum-Filter Improvement at Tonopah

Another step has been taken in the filter controversy. Under No. 1,078,994, Charles Butters has been granted U. S. patent on a new filter leaf which is designed to avoid infringement upon the Moore system as defined by the decision of the U. S. Circuit Court of Appeals for the Third Circuit[1].

As shown in the accompanying illustration, the new leaf is designed much as the former Butters leaf in that it consists of a pipe framing filled with coco matting, and covered by a canvas filtering medium. The wooden fillers are replaced by the coco matting, and no sewing is done on the leaf except the outside edges. The filtering medium is clamped together at the top by the header, and at the bottom is left open, terminating in a



THE NEW BUTTERS FILTER LEAF

short flap which closes when vacuum is applied and opens when vacuum ceases. An outside perforated flooding pipe is placed above the leaf header for discharging the cake. When the cake is to be discharged, vacuum is dropped, water admitted through the perforated pipe under more or less pressure and the cake discharged. The entire operation is effected outside the filter leaf and no difference of pressure between the inside and outside of the leaf is depended upon to secure the desired result. The Butters interests believe that the omission of this step avoids infringement of the Moore process patent. This new system has been in operation at the plants of the Belmont Milling Co., in Tonopah, and in Millers, since last May.

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Electrolysis of Cyanide Solutions, while apparently beneficial in laboratory tests, has not been able to demonstrate any consistent advantages in large-scale operations over long periods of time.

[1]"Eng. and Min. Journ.," Nov. 16, 1912, p. 923.

Strength of Adobe Brick

It is reported by *Engineering News* that tests on the strength of adobe brick were made some years ago by Herbert N. Alleman (now a resident of South America), assisted by W. F. Schaphorst, the latter of New York City, but at that time resident in the Rio Grande Valley. As is well known, adobe is the alluvial clay of southwestern United States and Mexico, which is formed into brick (usually 9x12x4 in. in size) and allowed to be sun dried. Mexican brickmakers generally add chaff or some other fiber substance for binding together the mixture. The ingredients are mixed without the aid of machinery. Peons tread in the wet mixture barefooted until the proper consistency for molding has been reached. When dry, adobe has the appearance of an ordinary chunk of dry, gray mud, but it will give a metallic ring when struck, similar to the ring of ordinary burned-clay brick.

The tests were made in tension on briquettes of 1-in. section, of the standard cement-testing type; in compression on 1 in. square by 5 in. long prisms (in compression along the 5x1-in. surface); and in flexure on 1-in. square pieces over a span of about 4 in. The average tensile value of the briquettes was found to be about 60 lb. per sq.in., few falling below that figure and some attaining a tension as high as 80 lb. per sq.in. The compression specimens ran up to about 500 lb. per sq.in. on the average, with not very great variation. The flexure specimens broke uniformly in tension with an extreme-fiber stress value of about 60 lb. per sq.in. All specimens were carefully made and were undoubtedly of considerably greater strength than would be attained by the materials commonly used and mixed in the usual way.

Adobe brick is an excellent building material for many purposes, as engineers who have operated in Mexico well know. There are adobe houses of great age still standing in Mexico, and showing but little deterioration. Much depends, of course, upon the character of the adobe. Ill-made brick of sandy mud may not last through a single rainy season, while properly made brick of a good kind of mud may stand exposure to the weather for 100 years or more. The authors of the statements quoted by *Engineering News* evidently referred to good brick. The high strength against compression that they report, viz., 500 lb. per sq.in. on the average, is surprising. This reminds us of an experience related by a smelter of our acquaintance. He built a battery of roasting stalls out of adobe brick in default of any other material. However, he found adobe brick to answer so well for this purpose that later on he would not have chosen any other material even if he could have had it. At one end of the line of roasting stalls, he turned up a little nub of a chimney. Of course, the draft was poor. In order to improve it, he raised the chimney 10 ft. at a time, being fearful to do very much lest the whole thing might crumble and fall. Having attained a height of 40 ft., his courage gave out and he stopped there. Now, a chimney of 40 ft. in height would have a weight of only about 43 lb. per sq.in. Assuming Mr. Alleman's figure of 500 lb., there was, of course, a large factor of safety. We should not, however, advise too much reliance upon any single figure of this kind, knowing very well the wide range of difference among several kinds of adobe brick. The dimensions of the Mexican adobe are frequently 4x8x16 in.

THE COST OF DOING THINGS

Kerr Lake Mining Co.

The Kerr Lake Mining Co., Cobalt, Canada, in the year ended Aug. 31, 1913, produced 2,109,075 oz. of silver and shipped 2,160,878 oz. to smelting works. The smelter settlements for shipments aggregated 1,977,870 oz., indicating a deduction of about 8.5% for losses, etc. After charging all construction to operations, a profit of $837,315 was carried forward for the year. This profit was accounted for in the following manner: Proceeds from sale of product, after adjustments of stocks on hand, $1,164,126; interest, $18,368; total receipts, $1,182,494; expenditures were made up of mining and development expense, $218,993; shipment, treatment, etc., $114,449; administration and general expenses, $11,736; total expenditures, $345,178. A dividend of $600,000 was paid to the Kerr Lake Mining Co., of New York, the holding company. Dividends to date aggregate $4,620,000.

The following tonnages were mined during the year: Sacking ore, first grade, 379 tons; second grade, 161 tons; jig concentrates, 192 tons; total sacking ore, 732 tons; mill ore, 16,625 tons; waste from bumping tables, 16,381 tons; total ore mined, 33,738 tons; mine waste hoisted, 9396 tons; total rock hoisted, 43,134 tons. The mill treated 18,252 tons of ore, averaging 29.29 oz. of silver per ton, 3389 tons of this ore came from dumps. The cost of mining and development was $5.07 per ton of rock hoisted for the following items:

KERR LAKE MINING CO. COSTS

Stoping	$0.435
Development	0.674
Power, light and heat	0.639
Ore sorting and jigging	0.356
Tramming	0.673
Hoisting	0.187
Timbering	0.396
Pumping	0.071
Drills and steel	0.216
Mine expense	0.260
Repairs to plant and buildings	0.138
Stable expense	0.121
Office expense	0.096
Surface maintenance	0.254
General expenses	0.023
Taxes	0.574
Boarding house	0.018
Total	$5.077

Other expenses, including milling but not smelting deductions, etc., bring the total cost of operating up to $8 per ton of rock hoisted. Development work performed amounted to 4984 ft., consisting of: 2974 ft. of drifting; 160.5 ft. of raising; 186 ft. of sinking and 1663.5 ft. of crosscutting. Development work to date totals 34,663 ft. It is stated that the ore reserves were only reduced 600,000 oz. of silver, leaving still approximately 6,000,000 oz. in reserve. Mine property account was increased from $55,000 to $130,000 by the purchase of an undivided one-half interest in the seven-acre Drummond tract. The balance of current assets amounted to $820,957.

In the treasurer's report the cost of producing an ounce of silver is figured as follows: Mining and development, 10.38c.; shipment and treatment charges, 10.45c.; administration and general, 0.56c.; total, 21.39c. per oz.

The company has undertaken jointly with the Crown Reserve Mining Co. to drain Kerr Lake, in order to develop and stope the orebodies lying beneath it. The plant for dewatering the lake consists of two pumping units of two centrifugal pumps each, the two units each being driven by a 250-hp. motor. The plant is mounted on a barge of 60 tons capacity and the water is pumped through a 20-in. pipe to Giroux Lake, 2700 ft. distant, against a head varying from 60 to 125 ft. It is estimated that from 300,000,000 to 400,000,000 gal. of water must be handled. The rate of flow from the pumps will average about 6000 gal. per min. for the entire operation. It is figured that once the water is out it will be an easy matter to keep the lake drained.

Liberty Bell Unit Costs

The following data were furnished by W. H. Staver, general manager, Liberty Bell Gold Mining Co., Telluride, Colo., and were taken from the records of the mine for the month of January, 1913. According to the records, 14,030 tons of ore were delivered to the mill; 8715 tons from stopes and 5315 tons from development work. All the ore from the stopes was mined by stulling. Development work consisted of 509 ft. of drifts and crosscuts, 320 ft. of raises and 2600 cu.ft. of stations and pockets. The labor employed was practically 20% American, 38% Scandinavian and 42% Italian, Austrian and Slav. According to the statement of labor about 121 men were employed at the mine; 65 in stoping, 30 in development, 4 general and 22 on surface. Of the men stoping, 12 were engaged in breaking ore, 4 shoveling ore to chutes, 14 tramming from chutes to shaft, and 35 in timbering and general work. In development, 9.6 men were advancing, 15 men mucking and tramming and 5.4 men timbering. From these figures it may be inferred that about 116 tons are secured per month per man employed at the mines, or a little over 3.7 tons per day per man. For men underground the average is about 144 tons per month, or 4.65 tons per day. It was estimated that 9700 tons were broken in the stopes, which gives an average of about 807 tons per month per man breaking ore or about 26 tons per day per man. It apparently required one man shoveling in the stopes to chutes for every 2179 tons delivered per month. The rate of tramming was about 20 tons a day per trammer from stope chutes to shaft. The ore in stopes was broken in 260 machine shifts or at the rate of 37 tons per shift. The development work was performed with 193 machine shifts. Dynamite consumption in stoping was equal to 1.98 lb. of dynamite per ton broken, the total consumption in development was 6280 lb. Timber consumption reported was as follows: For stoping and general, 13,016 linear ft. of stulls, 1884 bd.ft. of lagging, 31,000 bd.ft. of lumber; for development, 2600 linear ft. of stulls, 1350 bd.ft. of lagging; and 2200 bd.ft. of lumber. The lumber consumption for stoping and general work was about 20,000 ft. above normal.

Electric power is used exclusively and about 25 hp. is used a day for hoisting. Main drifts and stations are lighted by electricity and candle consumption is 4.42 per man in 8 hr. On an average of 50 to 75 machine drills are sharpened per day on an Ingersoll-Rand No. 5 drill sharpener, this requires two men actually three hours to sharpen and temper. In drifting, Ingersoll C-110 2¾ drills are used and on an average of 45 ft. of holes are drilled per shift, making two set-ups; the first requiring from 20 min. to 1 hr., including picking down, and the second set-up about 10 min. In stopes from 75 to 80 ft. of holes are drilled in an 8-hr. shift with Ingersoll BC 21 stopes. Oil consumption is ⅜ pint per shift.

In driving a 9x10-ft. drift through calcite, quartz, pyrolusite and silicified andesite it required 93 eight-hour shifts, or 90 machine shifts actually drilling 6 hr. each to advance 298 ft. There were two trammers and one machine man on each shift and on day shifts a timberman. Compressed air was from 90 to 100 lb. pressure and 2850 lb. of 40% dynamite was consumed. Actual time in timbering was 31 eight-hour shifts. The rate of advance was 3.3 ft. per shift, or 10.8 cu.ft. of drift per man hour. The dynamite consumption was about 1 lb. for 9.4 cu.ft. of drift. In raising a 17x4½-ft. raise 315 ft. it required one machine man 88 eight-hour shifts, drilling from 6 to 7 hr. per shift. All timbering was done by one timberman working an equal number of shifts. Dynamite consumption was 1650 lb., or about 14.6 cu.ft. of drift per pound of dynamite. The rate of advance was 3.6 ft. per shift. In tramming, a record for two months, in a drift on bonus working three shifts shows that one man shoveling from a plat averaged fifteen 33-cu.ft. cars in 8 hr. on an average tram of 200 ft. The average life of a mine car at the Liberty Bell is five to six years.

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West End Consolidated

A summary of the annual report of the West End Consolidated Mining Co., Tonopah, Nev., for year ended Mar. 31, 1913, shows:

Dry tons of ore shipped to smelter	129
Dry tons shipped to Nevada Milling Co.	44,521
Tons of waste to dump	20,464
Tons waste sorted from washer	10,238
Total tonnage handled	75,352
Cost per ton, ore and waste mined	$2.46

Mine—Receipts and Charges	Total Amount	Per Ton
Gross value of ore shipped to smelter	$11,792	$91.41
Gross value of ore shipped to mill	759,084	17.05
Gross value of ore shipped	$770,876	$17.27
Freight and treatment on smelting ore	$2,837	$21.99
Freight and treatment on milling ore	402,693	9.04
Total freight and treatment	$405,530	$9.09
Total mining expense on ore shipped	185,747	4.16
Profit from mining operations	179,599	4.02
Mill—Receipts and Charges	(44,756 tons)	
Gross receipts from treatment of West End Consolidated ores	$313,316	$7.04
Gross receipts from treatment of Gold Mountain lease	3,585	14.63
Total gross receipts from treatment of ore	$316,901	$7.08
Mill operating expense $162,449		
Purchased ore 1,987		
Total charges at mill	$164,427	$3.67
Profit from milling operations	$152,474	$3.41
Miscellaneous earnings, mine and mill	774	
Total profit	$332,848	

The report states that the company now owns 158.371 acres patented and 25.7 acres of unpatented claims, total, 184.071 acres. Most of the ore produced came from the south vein above the 500-ft. level. Development work amounted to 5859 ft. and consisted of 1546 ft. of drifts, 2078 ft. of crosscuts, 1512 ft. of raises, 383 ft. of winzes and 34 ft. of shaft sinking. The average cost of development was as follows: Drifting, $6.50 per ft.; crosscutting, $6.44; raising, $6.66; winzing, $13.39; shaft sinking, $27.78.

The extra excavations for the year, including winze and shaft stations, amounted to 251 cu.yd., at a cost of $4.77 per cu.yd. The following table gives details of mining and milling costs:

WEST END CONSOLIDATED COSTS

Mining	Cost per Ton	Milling	Cost per Ton
Superintendence	$0.135	Superintendence	$0.062
Breaking	0.802	Crushing and conveying	0.103
Timbering	0.090	Stamp batteries	0.248
Tramming	0.372	Tube mills	0.492
Hoist and engine room	0.200	Concentration	0.130
Ore loading	0.233	Agitation	1.033
Ore washing and sorting	0.366	Filtering and discharging	0.218
Ore sampling	0.004	Precipitation	0.260
Surveying	0.047	Elevating and separating	0.103
Surface and plant	0.135	Motors and lights	0.036
Assaying	0.040	Refining	0.097
Drayage	0.015	Drayage	0.010
2nd class ore dump	0.045	Assaying	0.042
Development	0.862	Steam heating	0.130
Electric wiring underground	0.012	Water	0.214
Shaft sinking	0.212	General expenses	0.110
Extra excavating	0.027		
Assessment work	0.011		
Total direct	$3.608	Total direct	$3.288
Salaries	$0.145		$0.074
Office expense	0.046		0.010
Legal and traveling	0.031		0.002
Taxes	0.012		0.040
Insurance	0.020		0.036
Depreciation	0.067		0.158
Automobile	0.044		
Bullion tax	0.131		
Liability insurance	0.058		0.021
Total indirect	$0.554	Total indirect	$0.341
Total operating	$4.162	Total operating	$3.629

At the mill the stamps dropped 94.7% of the total time, with a stamp duty of 6.12 tons a day. One per cent. of the lost time was due to lack of power and the remainder to repairs and holidays. During the last quarter the stamps dropped 97.4% of the total time and stamp duty was 7.26 tons a day. The total recovery of metals was as follows: Gold extraction, 94.24%; silver, 89.02%; total, 89.91%. The extraction of metals was made as follows, by cyanidation: Gold, 87.38%, and silver, 73.49%; by concentration, gold, 6.85% and silver, 15.53%; the gross content of the ore before treatment was 9357 oz. gold and 933,371 oz. silver. During the last quarter of the fiscal year, the cost per ton for the following in milling items was:

Labor, at an average of $4.50 per shift	$0.80
Power, at 1½c. per kw.-hr.	0.436
Cut zinc, 1.25 lb. @ 11.4c.	0.1425
Sodium cyanide, 2.46 lb. @ 25c.	0.614
Lime, 4 lb. @ 0.85c.	0.034
Lead acetate, ½ lb. @ 9.5c.	0.0475
Fuel oil for heating, 1¾ gal. @ 4c.	0.078
Water, 1.18 tons @ 18c.	0.213
Chrome steelshoes	0.0222
Cast iron dies	0.0092
Cast iron tube mill liners	0.044
Pebbles, 4.7 lb. @ $1.57 cwt.	0.074
Other supplies	0.2326
Total	$2.747

In the milling costs power is not charged as a separate item, being proportioned by meter readings to the different departments. The refining cost per ounce of bullion was 0.47c.; divided into labor, 0.185c.; supplies, 0.285c. per oz. Zinc cost per ounce of bullion, 0.95c., or 0.083 lb. avoirdupois per troy ounce of bullion. It is hoped to increase the tonnage by 50 tons a day without increasing the working force. The company closed the year with $168,192 cash in banks and $50,000 bills receivable.

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United States Mining Companies	Situation	Per Share	Total
Alaska Mexican, g.	Alas.	$0.20	$36,000
Alaska Treadwell, g.	Alas.	1.00	200,000
Alaska United, g.	Alas.	0.50	90,100
Arizona pf, B, c.	Ariz.	....	53,842
Bingham-Newhaven, c.	Utah	0.10	22,869
Bunker Hill & Sullivan, l.s.	Ida.	0.25	81,750
Bunker Hill Con., g.	Calif.	0.05	10,000
Eagle & Blue Bell, g.s.l.	Utah	0.05	44,657
Elkton, g.	Colo	0.02	50,000
Fremont, g.	Calif.	0.02	4,000
Frontier, z.	Wis.	2.00	2,500
Gemini, g.s.l.	Utah	10.00	50,000
Gethin-Leroy, g.s. l.c.	Utah	0.01	7,500
Golden Cycle, g.	Colo.	0.03	45,000
Hecla, l.s.	Ida.	0.02	20,000
Homestake, g.	S. D.	0.65	163,254
Miami, c.	Ariz.	0.50	372,202
Nevada Wonder, s.	Nev.	0.10	140,000
Parrot, s.c.	Mont.	0.15	34,477
Pittsburgh Silver Peak, g.	Nev.	0.02	55,800
Standard Con., g.	Calif.	0.25	44,598
Stratton's Independence, g.	Colo.	0.06	60,750
Tonopah-Belmont, g.s.	Nev.	0.10	150,000
Tom Reed, g.	Ariz.	0.06	54,573
Utah Con., c.	Utah	0.50	150,000
United Verde, c.	Ariz.	0.75	225,000
Wasp No. 2, g.	S. D.	0.01	5,000
West End Con., g.s.	Nev.	0.05	93,424
Yellow Aster, g.	Calif.	0.05	5,000
Yellow Pine, z.l.s.	Nev.	0.02	19,000
Yosemite Dredging, g.	Calif.	0.10	2,400
Iron, Industrial and Holding Companies	**Situation**	**Per Share**	**Total**
Amalgamated, c.	Mont.	1.50	2,308,319
Cambria Steel	Penn.	0.62½	562,500
Great Northern Ore	Minn.	0.50	750,000
International Nickel, pfd.	N. J.	1.50	133,689
National Carbon, pfd.	U. S.	1.75	78,785
Penn. Steel, pfd.	Penn.	2.50	413,500
U. S. Steel, pref.	U. S.	1.75	6,304,919
Vulcan Detinning	N.J.-Ill.	21.00	315,000
Warwick, I. & S.	Penn.	0.40	59,468
Canadian, Mexican and Central American Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	0.04	80,000
Buffalo, s.	Ont.	0.07	70,000
Cobalt Townsite, s.	Ont.	0.24	120,000
Crown Reserve, s.	Ont.	0.03	35,376
Cobalt Lake, s.*	Ont.	0.36	109,350
Chontalpan, g.s.l.z.	Mex.	0.50	3,500
Conigas, s.	Ont.	0.70	560,000
Dominion Steel, pfd.	Can.	1 50	105,000
Greene Consol., c.	Mex.	0.50	500,000
Hollinger, g.	Ont.	0.15	90,000
Lucky Tiger, g.s.	Mex.	0.06	42,920
Standard, l.s.	B. C.	0.25	50,000
Steel Co. of Canada	Can.	1.75	113,750

*English holding company.

There are no changes of importance except the increases by Golden Cycle and Lucky Tiger, and the initial dividend by Gethin-Leroy. The Standard Consolidated dividend is the first this year.

Dividends for the first 11 months of the year amounted to $64,519,256 paid by United States mining companies: $102,807,003 by iron-smelting, other metallurgical and holding companies; and $20,697,712 for other North American companies. This compares with $54,744,870 paid by United States mining companies for the first 11 months of 1912.

Mexican Financial Situation

SPECIAL CORRESPONDENCE

By the law of 1905, establishing currency on a gold basis, the peso is 75 mg. of gold, or one-half the United States dollar standard. The old peso fuerte, of silver, weighing 417.80018 grains, 902.777 fine, contains 377.2 grains of fine silver, and is worth 58c.. U. S. currency. The New York papers quote the peso at 47 and 48, but banks here allow hardly 36. The coin is being melted into bullion and sold for uncoined silver at a good profit. One firm a few days ago melted down 150,000 silver pesos. As our bank circulation is supposed to be secured by the equivalent of the silver in gold, the banks are refusing to exchange silver for bills. This refusal adds to our local distress and uncertainty, and many banks are on the verge of insolvency.

Zinc Smelting at Port Pirie

F. W. Reid, lecturer in metallurgy, South Australian School of Mines, Adelaide, has described in the *Mining and Engineering Review* of Oct. 6, 1913, the zinc smeltery of the Broken Hill Proprietary Co. at Port Pirie. The following is an abstract of his paper:

The blende concentrate, as received from Broken Hill, contains about 46% zinc, 8% lead, 30% sulphur and 13 oz. silver per ton. It is roasted in a Hegeler furnace, 79 ft. in length, with two tiers of seven hearths, each 6 ft. wide. The furnace was designed originally as a muffle furnace, the lowest three hearths being heated by gas firing. It not being desired to manufacture sulphuric acid, however, and it being found difficult to obtain a sufficiently high temperature for decomposition of zinc sulphate, the furnace was modified and is now operated as an ordinary reverbatory, the lowest three hearths being heated by gas obtained from Duff producers. The capacity of the furnace is 48 tons per 24 hours.

Retorts are made by hydraulic pressure in the usual way.

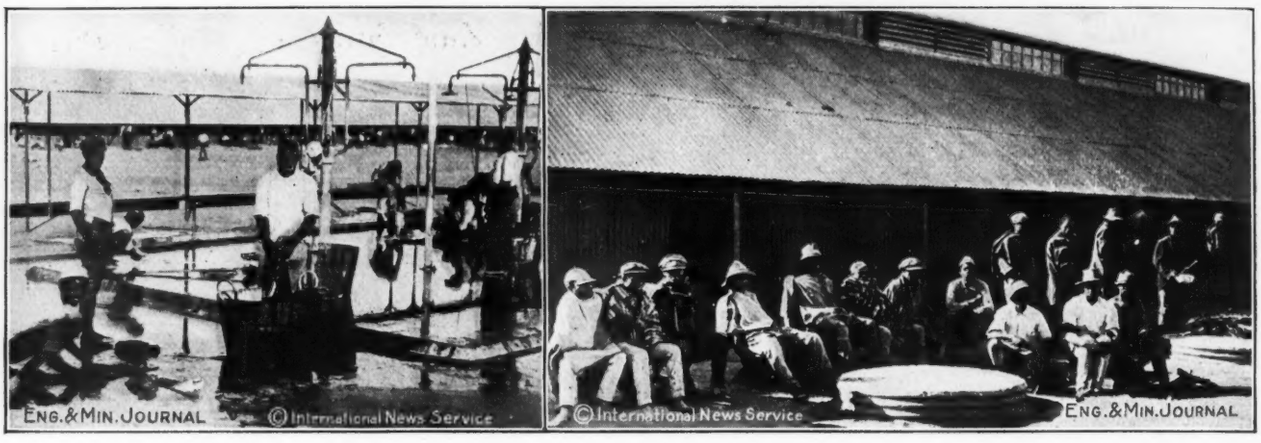
The distillation furnaces, 10 in number, are of the Rhenish type, with 144 retorts per furnace, arranged three rows high. The retorts are 66 in. long and 13x7 in. in cross-section. The furnaces are gas fired, and are of the counter-current, recuperative type.

The ordinary furnace charge is 10,000 lb. of ore, 3000 lb. of coke and 1500 lb. of coal, plus the condenser chippings and all the coarser powder of the previous day's work. The retorts are charged through the condensers.

In running the distillation furnaces, the temperature is taken at hourly intervals by means of a Wanner pyrometer. It is raised gradually until it reaches a maximum of 1325 to 1350° C. Spelter is drawn once per day, just before the day shift comes on. The retort residues are raked out. They are sent to the lead blast furnaces. Recovery of zinc in the form of spelter and marketable blue powder is said to range from 80 to 85%. The blue powder averages about 12% of the total product. It contains about 92.5% zinc. It is sifted through a 100-mesh screen and is boxed for export to San Francisco or Japan. The spelter contains 2 to 3% lead. It is refined by liquation in the ordinary way. The charge of the refining furnace is about 20 tons. The refined spelter contains less than 1% of lead.

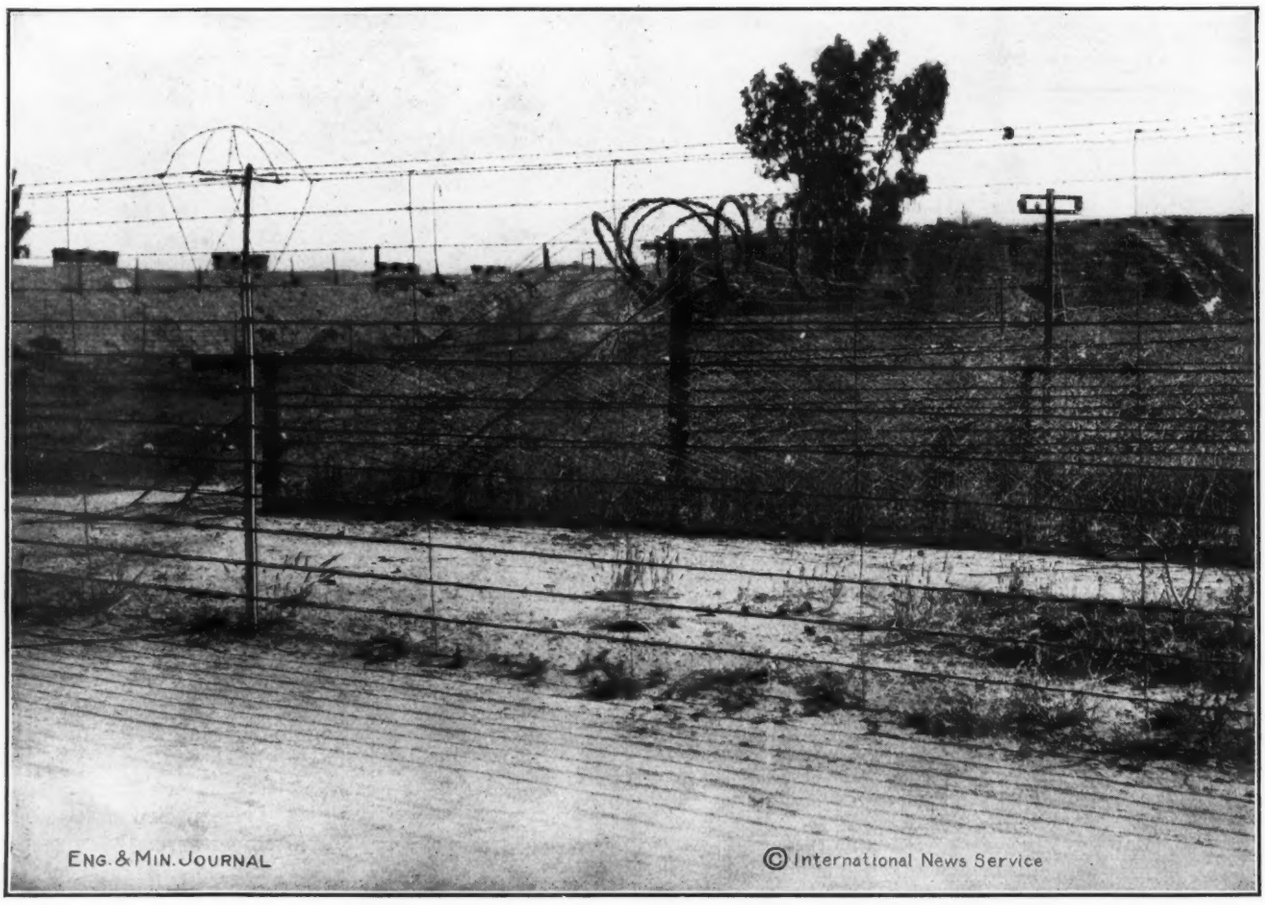
[It would be interesting to have all the data of the smelting of this ore. Apparently about 12% of the lead of the crude ore passes into the spelter. The lead tenor of the spelter is about what is to be expected in the smelting of such an ore at such a temperature. The latter is higher than some practice in the smelting of such ore, but is, of course, much below the temperature maintained in the smelting of some ores. The range of zinc extraction as stated is too wide to enable any good idea of the metallurgical efficiency to be formed.—EDITOR.]

PHOTOGRAPHS FROM THE FIELD



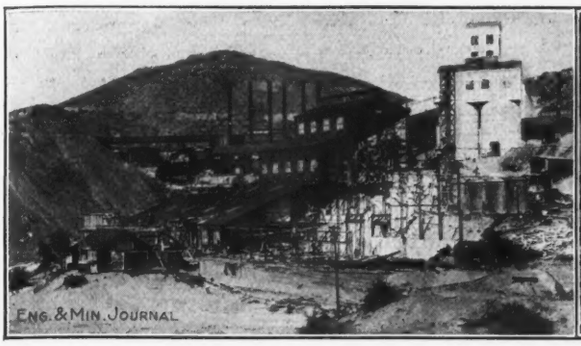
COMPOUNDS AT THE DE BEERS DIAMOND MINES AT KIMBERLEY, SOUTH AFRICA

The various tribes are alloted sections of the compound and prefer to keep their own company. The photograph at the left shows Kafirs washing their clothes in the compound. At the right a group of Basuto boys is shown; the man at the extreme left is not a jockey in spite of the cap. Fires are kindled on the circular concrete platforms, the one at the extreme right is burning and a boy is about to warm up something to eat. Evidently these black boys are as fond of a fire as Mexican peons.

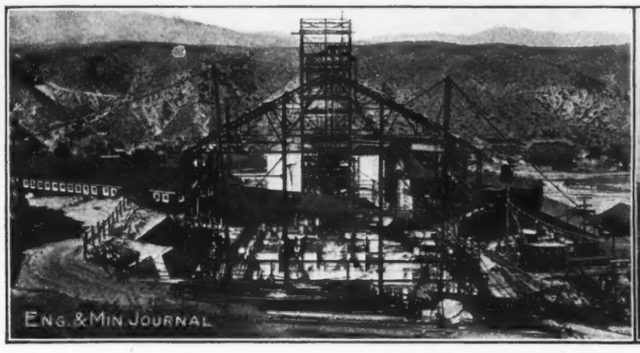


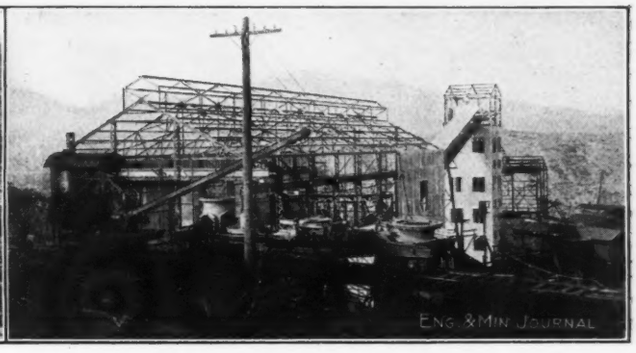
THE BARRICADE OF WIRE THAT INCLOSES THE DE BEERS DIAMOND MINES

About 4000 miles of barbed wire is used in this elaborate "cat teaser," one of the many guards against employees disposing of stolen diamonds.

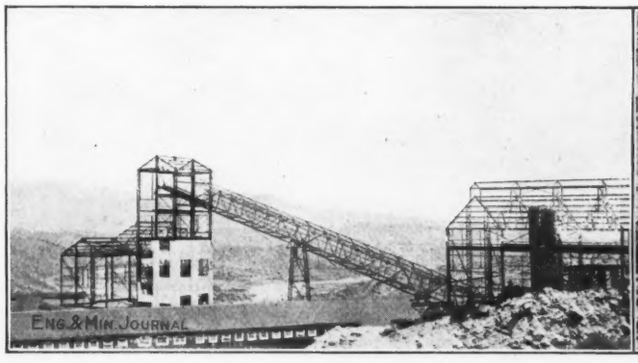


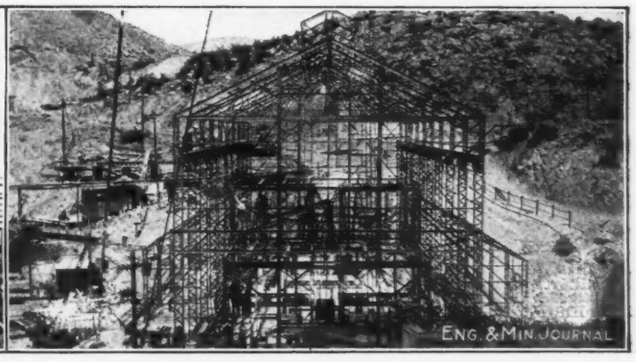
NEW CONCENTRATOR OF OLD DOMINION COPPER MINING & SMELTING CO., AT GLOBE, ARIZ.,
Site of new plant. Concrete ore bins 1000 tons capacity each.





VIEW THROUGH CRUSHING PLANT CRUSHING PLANT AND SAMPLING MILL
Both views are looking West; show plants in course of erection.





SAMPLING MILL, CONVEYOR AND CRUSHING PLANT CRUSHING PLANT IN COURSE OF ERECTION
This part of new works was lately completed.

WRECKING 15-YEAR OLD SHAFT HOUSE AT CLEVELAND IRON MINING CO.'S NO. 3 MINE AT ISHPEMING, MICH.
After cutting props on north and south sides six sticks of powder brought down the dangerously rotten structure.

Coal Prospects in Matanuska Field, Alaska

The initial prospecting for coal in the Matanuska field, Alaska, inaugurated by the U. S. Bureau of Mines for the Navy Department has been completed, and Dr. J. A. Holmes, director of the bureau, under whose supervision the work was carried on, returned to San Francisco en route to Washington on Oct. 20. Doctor Holmes made the following statement to the JOURNAL representative at San Francisco:

"Our special work in Alaska was with reference to finding a quantity of coal suitable for naval use and under conditions suitable for mining operations. We had 20 miners to aid the mining engineers and finally selected one opening on the Matanuska River that covered about 800 tons of coal, which is to be brought down the Matanuska River on the ice to tidewater during the coming winter. There it will be turned over to the Navy Department for actual ship test by one of the cruisers. The situation of the Matanuska field is about 45 miles northeast of the head of Cook Inlet. George Watkin Evans, mining engineer, of Seattle, was in immediate charge of the prospecting and extraction of the coal. He has just finished his part of the work and returned to Seattle.

"The work remaining to be done is to get the coal to tidewater; but this cannot be done until the river freezes solid. The bringing of the 800 tons of coal a distance of 45 miles over the ice is a more serious problem than prospecting for coal during the summer. The coal will be carried on No. 5 Common-sense bobsleds hauled by two or four horses to each sled as may be required. Double-ender sleds, each pulled by one horse, will be employed as supplementary to the larger sleds. The condition of the ice on Matanuska River is what makes the problem of haulage a serious one. The climatic changes are irregular. The ice breaks and the water overflows, freezes into ice and breaks again forming a rough surface, and the wear of the projecting ice quickly mixes with the snow and becomes slush. There is added to this difficulty the fact that the banks of the river are sandy and gravelly in so many places and the wind frequently drives the sand and gravel over the ice, forming a sanded floor instead of a smooth ice surface. These are the problems to be met and the hauling of this coal down the river will be an experiment, as it will be the first attempt made at hauling large quantities and heavy loads. The coal-carrying capacity of the single-horse double-ender sleds is about two tons. The capacity of the No. 5 bobsled is four or five tons. Bins or sled boxes will be built on the sleds and the coal loaded in as compact form as possible.

"There has been one experiment made, in hauling a small sawmill up the river by one of the mining companies using horses and sleds, but I understand it required more than one month of time to make the trip of 45 miles. During the past winter mining companies on Copper River, where the conditions are somewhat similar, were able to make an average of five miles a day with horses and sleds. They hauled over two or three tons on single-horse sleds. They solved the problem of smoothing the roadway by using a snow-plow which was pulled by eight horses. The snow-plow went ahead of the double-ender sleds. The purpose was to push all the rough ice and snow out of the way and leave a smooth track. They hauled their machinery, including steel pipe for hydraulic work, a distance of 260 miles into the interior of Alaska, following this method of haulage.

"The Matanuska River region never gets as cold as in the interior and the new ice that forms on top of the overflows on the river is not always very strong. The region is so isolated during the winter that we cannot take in either horses or supplies after early November and we cannot get them out before about the first of May. It is estimated that during that time the winter conditions will probably be favorable to hauling the coal for not more than two months of actual time; but whether it will be the first two or the last two months or scattered through the season one week at a time, nobody knows. So it required preparation in excess of what would ordinarily be required if good conditions were assured.

"The Matanuska region gives greater promise of agricultural development than any other part of Alaska

MATANUSKA, ALASKA, COAL FIELD

that I have visited. It will be an easy region for the building of railroads and public highways, so that an agricultural population can easily develop there which would supplement the mining operations."

Doctor Holmes before going on to Washington arranged for the chartering of a steamer to carry horses and supplies to Alaska for the work of transporting the coal from Matanuska field to tidewater. The sleds to be used will probably be obtained in Alaska. The steamer will go in through Cook Inlet and dock at Ship Creek on the inlet. The horses and supplies will then be lightered over the tidewater flats of Knik arm to the mouth of Matanuska River at the head of Knik arm, a distance of about 15 miles. The coal camp is at Chickaloon, which is on the north bank of Chickaloon Creek, near its confluence with Matanuska River. The accompanying sketch map gives the approximate boundary of the coal fields and the geographical situation of the camp. The coal fields lie between Susitna River and Copper River. The situation is about 120 miles southeast of Mt. McKinley and about 100 miles north of Prince William Sound.

CORRESPONDENCE AND DISCUSSION

Butte versus Michigan

In reply to Mr. Guck in the JOURNAL of Nov. 8, I beg to suggest that the Cornish miner of Calumet (or the Cousin Jack, as he is more familiarly known) must have paid a very short visit to Butte and left before he had time to find out conditions, or else he is telling the story because "there's a reason."

I am living midst scores of Cousin Jacks who have been in both places. Mr. Guck states that one lived in an unsuitable house in Butte for which he paid $11.75, and for a good house he would have to pay nearly $20.

Quite so, but if he had stayed there as long as he has no doubt stayed in Michigan he would probably own a house.

He lived in a company-owned cottage in Michigan for which he paid $5. Does he not earn enough for the Calumet & Hecla in the mines, or does he want to pay more rent and allow them to pay $3,000,000 annual dividends from that source also? If he lives there long enough he will pay for the house but he will never possess it.

He states that in Butte, coal is $18.50 per ton and slab wood $8.50 a cord. Does anybody with a mind of his own believe that such prices exist in any city in the United States? My figures on the above are as follows: The best coal obtainable, which he termed Rock Spring coal, is $8 per ton, and Diamond coal is $7.50 per ton. There is also an inferior coal which can be had for $6. Wood is sold by the wagon load, slab wood $4 and log wood $6, and a load is considerably more than a cord.

Below is a rather vague comparison between the two places, and if one goes to the trouble of obtaining items one will find that I am giving Michigan the benefit of any doubt:

Michigan		Butte	
Average wage	$65	Minimum wage	$112.50
General expense	25	General expense	50.00
Balance	$40	Balance	$62.50

The highest a man pays for room and board is $1.50 per day or $45 per month, but it is obtained by hundreds of men for $1 per day or $30 per month. The lowest paid miner in Butte gets the above wage, and up to a few weeks ago he was getting a matter of $7.50 per month more.

There is a man sitting next to me at this writing who says he worked a few years ago at Tamarack as a shift boss for $2.25 per day, which was eventually increased to $2.50 per day.

The difference he makes in flour is $1 per sack, and a sack will last him well over a month; you have the extra price for flour in one day's wage, so you have still 29 days in which to make up the remainder of the excessive prices.

I am continually in contact with scores of miners of all nationalities who have mined all over the United States and Canada, but I have yet to meet the first one that prefers conditions in the state of Michigan to those in Butte, Montana.

WILLIAM LAKELAND.

Greenwood, B. C., Nov. 14, 1913.

[According to the report of the committee of the Copper Country Commercial Culb of Michigan, the average wages received by miners in the Lake Superior region, during the six months from Jan. 1 to June 30, 1913, was $3.20 per shift; of trammers, $2.63 per shift. These figures were arrived at by dividing the total amount of the pay rolls of the respective companies by the number of shifts worked. With respect to the relative cost of living in Michigan and Montana, the committee reported that "on a grocery and meat bill of $35, which is fairly approximate for an average miner's bill, there is a saving in Michigan of 25% over the Butte prices; in other words, the same articles in Butte would cost $8.75 more." The committee quotes hard coal in Butte at $16 per ton against $8@8.50 in Michigan. It quotes soft coal in Butte at $7@7.50 against $4.50@5 in Michigan.—EDITOR.]

Grinding Ores for Cyanidation

In H. A. Megraw's article on this subject, in the JOURNAL of Nov. 15, 1913, he states, following a quotation from an advertisement of a screening machine, "It certainly looks as if the product of the Hardinge mill had to be screened and the oversize returned, and if this is true, the cost of screening ought to be charged against the mill and not dropped out simply because a separate machine happens to be called upon to do the work." At the plant of the Miami Copper Co., which is the one under discussion, the 8-ft. by 22-in. cylinder Hardinge mills are followed by classifiers, various products from the spigots going to tables for concentration. No screening is done following these mills, and, therefore, no oversize is returned and the item of screening is not chargeable to Hardinge mill grinding. The above information regarding the flow sheet of the Miami plant has been obtained from an article in *Mines and Methods,* January, 1913.

Mr. Megraw also states, "It is seen that the amount of minus 200-mesh material, which is what the cyanide plant wants, is greater in the product of the chilean mill than in the product of the Hardinge." In this connection it may be worthy of note that the Hardinge mills in use at the Miami plant have cylinders only 22 in. long, which is a type designed for grinding for concentration where a minimum of slimes is desired. When the metallurgical treatment of the ore requires a greater proportion of slimes the method of operation of the mills is changed materially and the length of the cylindrical portion may be increased from 48 to 72 in., depending upon the character of the ore and other local conditions.

Another point which may be mentioned is the amount of water used in Hardinge mill grinding. At Miami the feed to the mill contains probably in the neighborhood of 60 per cent. water and if this were reduced to about 40 per cent., the proportion of slimes would be much greater. An excess of water in grinding will carry out

the fine particles and prevent their being further disintegrated. The reverse is the case where a small amount of water is used, these small grains being allowed to remain in the mill for further comminution.

R. B. T. KILIANI.

New York, Nov. 25, 1913.

The discussion by Mr. Kiliani adds to the information on this interesting subject. Referring to the Miami mill, the explanation that the Hardinge-mill product is not screened must be accepted as correct. That such screening is required in other plants doing similar work, however, is probably true. Circumstances, principally the disposition of the product, will alter the methods followed. More data on the actual steps followed should be published.

The information that the form of the Hardinge mill is changed when more slimes are required is enlightening. Is it suggested that the nearer to tube-mill form the more slimes in the product? If so, why the cone? I would like to have some more data about the changed method of operating the mills when greater quantities of slimes are required.

As to moisture percentages, I agree with Mr. Kiliani. The facts conform to general experience.

H. A. MEGRAW.

New York, Nov. 29, 1913.

Companies Claiming to Want Mines on a Fair Basis—Faking

On p. 827, of the JOURNAL of Nov. 1, are named a number of companies and individuals who are on the lookout to buy, or invest in good mining property.

The impression created by this article is wholly foreign to the facts in nine out of ten cases. I have had some occasion personally to see a number of the parties and companies you name in reference to a gold-mining property of the first character with a view of having them acquire an interest upon lines fully protecting them and upon the same basis I paid after I had taken the risk and proved it up. My experience justifies me in the claim that the most of these persons or companies are doing the spider-and-fly act like the public was fleeced on Nipissing some years ago by a deliberate conspiracy for that purpose by some of these persons and concerns you name. Not one of them could find any fault with my property, but still they were not inclined to deal on a basis more fair to them than myself. I was not to receive a cent of their money. What they put in was to go on the property only through their own agent.

At one place, which wears peacock feathers in its hat, some spruce young office engineer, who, in my view, knows as much of practical mining as a sick cat, wanted me to put up $5000 for an examination, and then $20,000 to enable him to duplicate some exploration work, after which, he said, "we will be prepared to talk."

No sane man would entertain such a proposal. It was a mere scheme of graft which, in my opinion, is actively going on in some of these offices, possibly behind the backs of the principals. To prove that the firm was a bunch of fakers and not looking for anything except on the spider plan, and to convince an intermediary that I was right, I finally agreed to it on the one condition, that they would buy the proved-up ground at a cost of about one-third of the net and pay for it as proved up. Any concern that really meant real business in any sense would have jumped at it and yet this was one of the so called big men or houses of the Street.

In various others, instead of finding representatives with some genuine mining knowledge and appreciation of the possibilities of a big and rich property, I found some youngster, who possibly is an E.M., yet needed a kindergarten course. Mining in a soft office chair, however, has its allurements, and to be sure of holding the job and convincing their employers that they are "highly conservative," these amateurs turn down everything.

From my observation of this alleged gentry and companies who are supposed to be looking for mines, I am quite convinced that that is the very last feature of their business; that their office representations are incompetent; that there is no likelihood of being able to get a square deal from most of them. Their principal business seems to be to "turn down" everything which is presented them, due to their siren song, and, of course, included formerly in the lot is Tonopah Mining, Calumet & Arizona, and dozens of other big producers. I doubt if one of these concerns would give a moment's attention to a "prospect" of the utmost promise, as they act as if they felt the real miner should deposit his bullion or metal on their office floors and then ask them to take it at 20% of the market price.

There seems to be a concert of action among them to discourage every sort of mining that doesn't originate with them. They want thoroughly proven or dividend-paying mines at the price of "prospects." The obstensible purpose of their existence or claims is not their real purpose by a long shot. To me their methods look like those of fakers.

WILSON M. TYLOR.

103 Park Ave., New York, Nov. 17, 1913.

[After our receipt of the above communication, we happened to observe the following advertisement in the New York *Sun*, of Nov. 22.—EDITOR.]

AN ENORMOUS PROPERTY
An Immense Money Earner
A Wonderful Opportunity

Over 2,000 acres, over 20 miles of a gold lead with a known record of nearly 10 millions to the mile. Will begin to pay great dividends in 1914. Last development capital now accepted. Don't miss this chance. Cut this out. Write at once. Every $100 will earn a $1000 quickly. What can you invest if proposal suits you? First mortgage immediate income security. Address W. S. TYLOR, 103 Park Ave., New York.

Climate of Johannesburg

Referring to the statement in the editorial in the JOURNAL of Nov. 1, entitled "Colonel Gorgas at Johannesburg," that "Johannesburg has been the center of one of the world's most renowned malarial districts." In reply to this I would like to state that the region around Johannesburg, known as the high veldt, is one of the finest and most exhilarating climates in the world and that the Transvaal and British South Africa, with the exception of a small portion of the Transvaal along the Limpopo River, is quite a healthful climate. The fact that invalids are sent from England to the Transvaal and Cape Colony, just as in this country they are sent from the East to California, will prove the above statements.

N. L. CALDER.

New York, Nov. 1, 1913.

EDITORIALS

The Troubles of the Potash Industry

Somewhat over two years ago, at the time the so called American contracts were under discussion, the German potash industry was placed in a position which certain financiers and economists in this country apparently regard as ideal. A bill was passed by the Reichstag placing the industry under very close control. The business and production were to be carefully apportioned among the different companies and prices were to be closely regulated, a committee of the Imperial Council being given charge of the whole business. Companies were strictly prohibited from selling below the prices fixed by the governing committee, and it was provided that no new concerns were to be admitted to the allotment for a certain number of years.

While the immediate object of this legislation was to prevent certain companies from selling potash to their American customers at a lower price than was charged at home, the whole business of the industry was carefully gone over and it was thought that a permanent solution had been reached. Only two years have passed now, and the potash trade is in a thoroughly demoralized condition, which legislation has been entirely unable to prevent. In fact, government regulation, as a preventive of business confusion, seems to have completely broken down; and this is the more remarkable because Germany has a practical monopoly of potash production, and no trouble has arisen or is likely to arise from foreign competition.

The first cause of the trouble seems to have been that the industry was made apparently too sure and too profitable. Notwithstanding the limitations placed on new mines, the prospecting for deposits has gone on, with the result that new areas where potash can, in all probability, be profitably mined, have been discovered in Alsace, in Baden, in Hanover, and elsewhere. New mines have been begun and these under the law will be able to demand quotas of the production in two or three years, which, of course, will be deducted from those of the older mines, although there has been a large increase in production. It seems as though this increase had been rather forced and that very near the possible limit of profitable sales had been reached under present conditions. Until a further development of the use of potash in agriculture is realized, there will not be much room for further expansion.

One result of the present condition is that there has been a heavy fall in the prices of the shares of potash mining companies. The banks have become reluctant to advance money on these securities, and are also declining to advance money to the companies themselves, so that it is becoming difficult for them to raise the amounts necessary to develop their mines, or to increase production, and some of them are reported to be seriously embarrassed financially.

The Imperial government recognizes, apparently, the fact that something further must be done to help out the beneficiaries of the potash law. The law has certainly gone crooked somehow, but just what steps can be taken to amend it is a question which seems to have taxed the wisdom of the Imperial Council, for while the new bill was to have been submitted to the Reichstag six months ago, it has not yet been introduced in that body. It does not seem probable that anything much can be done beyond the further restriction of the opening of new mines and the holding down of production as nearly as possible to the limited demand. The question, however, is complicated by the fact that while a few years ago there was no state ownership of the potash mines, except by the Kingdom of Prussia, mines are now owned by several of the smaller states, such as Anhalt, Baden and Saxe-Weimar, and even in Germany, the minor states have some rights which they are not slow to claim. The Kali-Syndikat or potash trust, is in great trouble, and although some inconsiderate people have suggested that it be left to work out its own salvation, that proposition does not seem to meet with favor from the German authorities.

On the other hand, governmental control of industry does not seem to have been a sure panacea for all troubles, as certain economists would have us believe.

✖

Some Reflections on Mexican Matters

There is a phase of the Mexican question which does not seem to be sufficiently realized. It is that the ownership and operation of the great industries of the country are under control of foreign corporations, and therefore the flow of dividends is abroad instead of being used at home for the further development of manufactures and commerce. In this respect Chile and the Argentine Republic afford a striking contrast to most of the other Spanish-American republics, and it can hardly be accidental. They were the poorest of the old Spanish provinces, producing little or none of the precious metals, which were the food upon which Spanish vices were fed. The Spanish bureaucracy was rampant with all its evil influences in Mexico and Peru, including Bolivia, where the enormous wealth in silver created degeneration, as wealth does everywhere. Chile fortunately escaped because poor; and we see the results today in honest government and active industry, carried on in great measure by the Chileans themselves. When Chile was at the height of its copper production in the '70s (occupying in the world relatively the same position, as regards copper production, as we do today), the big copper mines were owned and operated by Chileans, who used the profits for the development of the country instead of exporting them. The Mexican government, under Diaz, appreciating the necessity of controlling and owning the railroads, took perhaps the first step toward remedying this great national defect.

It is not the fault of foreign capital that the Mexicans

themselves have not the courage to work their own mines and develop their own agricultural resources, for they have the ability and could employ, as the Chileans did, foreign skill. Conditions being as they are, the Mexicans can simply grumble, and vent their jealousy against the foreigner, who is doing what they ought to do themselves. But one sees no appreciation on the part of the wealthier classes in Mexico of the necessity of either combining with foreign capitalists or following their lead in developing their great mineral resources. They display even more disinclination to adopt modern methods of farming in utilizing the prodigious agricultural capabilities of the country south of the City of Mexico. If the revolution could stimulate Mexico, as the Civil War stimulated this country, it would mark an era of progress that would be a turning point in the history of the Republic. Unfortunately, however, the ideals of none of the parties who are struggling for supremacy are as elevated as those which inspired the dominant forces in this country in 1860.

Black Hills Lithia Deposits

The Black Hills lithia deposits, described in our leading article for this week, are of particular interest, inasmuch as they are, to the best of our knowledge, the only deposits in the United States at present worked for lithium, although California has some deposits of potential value. That the Black Hills deposits are ample for all demands for some time to come seems to be indicated by Professor Ziegler's article, since there are extensive spodumene deposits held in reserve against the exhaustion of the still large ambyigonite mines.

The greatest hope for this industry is in the success of the alkaline-electrolyte storage battery, in which, we are informed, lithium hydrate is used, presumably to precipitate the carbon dioxide taken up from the atmosphere.

As is noted in the article, one cannot but wonder under what conditions crystals of spodumene 42 ft. long are deposited. Perhaps some laboratory will some day acquire 50-ft. test tubes from the Carnegie Institution and endeavor to solve this problem.

International Atomic Weights

For the comfort of those chemists who desire accuracy, and hence go to the trouble of continually keeping the latest table of atomic weights at hand, it may be mentioned that this year there has been no change in the weights as approved in the report for 1913 of the International Committee.

Researches have been conducted on the weights of nitrogen, chlorine, bromine, phosphorus, iron, cadmium, tellurium, scandium, yttrium, ruthenium, palladium and radium. While in no case did this work warrant any change in the atomic weights as previously given, there seems to be some reason for believing that radium may have an atomic weight of about 226.0 rather than 226.4. Just what effect the acceptance of the lower figure will have on the present theory of the relation of niton, helium and radium, and the present accepted weight of niton, to say nothing of the lower disintegration products, is an interesting thought.

The whole question of the determination of these weights, when one considers the effect of inter-related errors in the atomic weights of the various substances in the compound used for analysis; errors due to impurities, both in the substance analyzed, in the reagents, and in the solvents; of the solubility of the precipitates; make one only hope the more that the day may come when the electron theory or its equivalent may have its Leverrier and that the atomic weights may be calculated once for all, to be later verified by observation.

The question of iron-ore rates from the mines of Minnesota to the Lake Superior ports has been taken up again by the Interstate Commerce Commission and is to be carefully considered on its merits. The reduction of 25% made last year is not considered sufficient by many of the shipping interests who point out that the ore traffic is one easily handled, is carried without break from shipping point to the ore docks, and is delivered in large quantities, permitting heavy train loads and cheap operation of the roads. Undoubtedly, it is a traffic which should command low rates. Moreover, the ownership of the carrying roads by one of the shipping interests, gives that interest an undue advantage, since the cost of carrying its ore is really offset by whatever profit may be derived from the railroads. All these points will be considered by the commission and it is quite probable that a further cut in rates will be ordered.

In the last two or three weeks there have been considerable exports of gold from England to India, notwithstanding the rather unfavorable reports as to the Indian crops. These, perhaps, have been too pessimistic, for the people of India themselves seem to have confidence in the future. The point is that they are taking gold, and to an almost corresponding degree, have been neglecting silver. The tendency of the Indian people to hoard gold rather than silver, seems to be on the increase, and it may be a matter of considerable importance in its relation to our gold supply. It may also be a matter of importance to the silver producers, whose market may be reduced to an appreciable degree. The silver market is rather weak, just now, owing to the lesser immediate demand, and also to the fact that China and Australia have been shipping silver to India, thereby reducing the amount required from London.

Copper smelters, as well as zinc smelters, are troubled by the concentrates produced by the flotation process, especially by their excessive fineness. To begin with, the drying of this material, of pasty consistency, is no simple matter. When it is finally dried it begins to blow away. The real trouble commences, however, when it is put into the furnace—roasting furnace, reverberatory, blast furnace, or whatever it may be. We imagine, though, that the troubles of the zinc smelter are a good deal more serious than those of the copper smelter. However, the smelters of all varieties are philosophic about the matter. They recognize that the new class of furnace material is bound to increase in volume and importance, and that it is up to them, the smelters, to handle it.

BY THE WAY

Rafael Lopez, a notorious man killer of the Rocky Mountains, had a great fight among the mines of Bingham, Utah, last week. First he killed a miner in Bingham, then three policemen who pursued and cornered him. Finally he was cornered again in a tunnel of the Minnie mine, where he killed three more deputies of the posse, who at last accounts were trying to bulkhead him in the mine.

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A director of one of our important mining companies called on Secretary Bryan not long ago to make some representations respecting Mexican affairs. This director had interests in Mexico, and, consequently in the opinion of Mr. Bryan, was one whose information and advise were of no account, and was one of those to be shooed away in the speediest fashion. The opinions of men who have lived and worked in Mexico are not valued in Washington in these days. In the course of this particular dismissal Secretary Bryan remarked. "Why, these men who are fighting for constitutional government in Mexico are patriots like our own who battled at Bunker Hill." Thus are Villa and Salazar and their fellow bandits appreciated.

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The Golden Rule was "galvanized" into the dealings of competitors in the steel-manufacturing business by the good example set by the U. S. Steel Corporation, according to C. C. Smith, of Pittsburgh, president of the Union Steel Casting Co., who was a recent witness at the hearing in the government's anti-trust suit against the Steel Corporation. "So before 1902 you were malignant enough to rejoice in your hearts over the misfortune of competitors to whom you were lying?" asked Judge Dickinson for the government. "It is really true," said the witness, "But I don't like the use of the word 'lying.'" Since the example of the United States Steel Corporation came to be a factor in the business, the witness said, competitors did not lie to each other about their business and openly visited the plants of rival concerns. Judge Dickinson classed this change as a "process of spiritual progression." "Did you follow the United States Steel Corporation's good influence by means of pools which existed in those years?" inquired Judge Dickinson. "Oh, no," said Mr. Smith. He added that he did not consider "those pools" an uplifting influence and that he separated the good influence of the Steel Corporation from the bad influence.

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The following advertisement appears in a Southern paper: "Lead and Ore Samples from the property of the Thornton Lead & Steel Corporation, formerly known as the Cottrell Farm, on the Tennessee River, just below Knoxville, are on display in the show windows of Hope Bros., Jewelers, 519 Gay St. This deposit of lead ore is confidently claimed to be the largest pure lead-ore deposit now known in the world. With the ore there is also a large percentage of red potash, which will make the finest natural fertilizer on the market. It is to be developed immediately by the Thornton Lead & Steel Corporation, a company just organized under a North Carolina charter at Hickory. Col. M. E. Thornton, the head of this enterprise, which is to be a very large one, will be in Knoxville a few days at the Atkin Hotel, and wishes subscriptions to the preferred stock of the corporation, which stock will yield 10% per annum, if not 14%. This affords an opportunity for investment in a home industrial enterprise, the like of which was never known before, here or elsewhere." It will be noted that this lead-ore deposit is the largest known. The surprising thing is the wholehearted generosity with which the gentlemen at the head of the enterprise are willing to share their remarkable find with the public. If we are ever fortunate enough to uncover a bonanza like this we shall hold on to it pretty tightly. Incidentally, what is red potash anyhow?

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Another lawsuit in Boston, that great arena of financial-mining litigation, has brought Thomas W. Lawson and the history of the Amalgamated Copper Co. once more into the spotlight. Asked what his business is, Mr. Lawson replied: "Farmer, author and banker." He said he participated in the original organization of the Amalgamated, being associated with the late H. H. Rogers and A. C. Burrage. Conferences had been held as far back as 1896. The consolidation was for the purpose of more advantageous and profitable conducting of the copper business. It was planned to purchase all producing companies, including the Rio Tinto mines, he said, wherever possible, through acquisition of a majority of the stock. Mr. Lawson related how the United Metals Selling Co. was formed by the Amalgamated company, saying in part: "Formation of this company was in line with the general scheme, continuing all the way through. It would have been very essential to have the marketing of the whole product of the mines controlled or owned by the consolidated company, as the very foundation and idea of the scheme was control of the price of the metal, as it would have enabled us to have established and held the metal at a fair price." Senator Walsh asked Mr. Lawson why, on formation of the Amalgamated company, it did not immediately acquire the Boston & Montana and Butte & Boston properties. Mr. Lawson replied: "We had intended to have the Boston & Montana and Butte & Boston the first stocks to be absorbed, but in the meantime Mr. Rogers had been able to acquire from Marcus Daly control of the Anaconda property, control of which had not been originally contemplated until after the Boston & Montana and Butte & Boston properties had been arranged for. That would have necessitated a larger amount of capital at the start, and Mr. Rogers and Mr. Rockefeller and other associates thought it inadvisable, so it was decided to bring the contemplated company to the public in sections, and what was to have been the first section was shifted to the second." "Had you and your associates acquired control of the Boston & Montana at that time?" asked Senator Walsh. "No," replied Mr. Lawson, "but we could speak for control of it." "Who was the master mind in the consolidation?" asked Senator Walsh. "H. H. Rogers," replied Mr. Lawson. "On whose suggestion did he become interested?" asked the senator. "On my suggestion," replied the witness. The present litigation pertains to an attempt to have the transfer of the control of the Alice Gold & Silver Mining Co. to the Amalgamated declared null and void on the ground that the Amalgamated was organized as a conspiracy in restraint of trade.

Gold Production and Prices

The skepticism among British and French economists respecting the quantity theory of money, and in many cases their direct challenging of it, have weakened the position of our American economists who but a few years ago were teaching that the increasing gold production was the principal cause of increasing prices. Recent events have also been an object lesson. Anyway, there always were some American economists who took the opposite position. It is refreshing to find such a lucid expression of a clear perception as these words of David Starr Jordan:

What shall we say of the theory that prices rise steadily because too much gold is produced to meet the needs of business? And what of the plan steadily to increase the size of each gold coin that its value may keep pace with the rise in cost of living?

We shall say that there is no such redundancy of gold. The idea that the commonness of gold the world over is the cause of rising prices, finds little favor among bankers. It is indeed a patent fact that there is no such surplus of precious metal as to cheapen its actual or relative value. The business world is suffering from a scarcity of gold which goes with excessive borrowing and excessive taxation. Both of these conditions are due in part to the rush toward the cities and toward urban industries, but chiefly to the demands of actual war in the Balkans, and threatened war elsewhere in Europe; and to frustrate war, as shown in the relations of Germany, France and England. But other causes cooperate to make gold scarce while prices still rise. For example, the savings of four hundred millions of Hindus are represented by British coin. In default of banks, most of these savings are buried in the ground. It is estimated that in Asia as much gold is returned to the ground each year as is taken from the mines of the world. Assuming that each native of India saves £1 each year on the average, this would mean $2,000,000,000 withdrawn each year from circulation.

Besides all this, millions of men are withdrawn by conscription and by enlistment from productive service, to become taxeaters on an enormous scale. The capital of the world is largely spent in waste, and this to a degree which is growing so rapidly as to excite alarm among all financiers who look more than ten years into the future.

The remedy, then, is not larger coins, nor a higher charge for seignorage, but less waste. There is not gold enough to go around in the business of the world. There is not enough of food or useful things produced. Too many men are working at useless things, and the working and business world have too many soldiers, protecting the men who work, when the only protection the working men of the world need is defense from the necessity of fearing soldiers or of being soldiers.

Zinc Smelting in Kansas and Oklahoma

SPECIAL CORRESPONDENCE

I have just returned from a trip through the Kansas-Oklahoma zinc-smelting district, and find the outlook gloomy and everybody pessimistic. The works at Dearing and Caney have been closed down, and all furnaces at Altoona have been put on dead-fire. The several works at Bartlesville and Collinsville are being operated at greatly reduced capacity.

It seems to be the general impression in Oklahoma that owing to the scarcity of gas no new improvements in the smelting works there will be made from now on. Probably there will be more new works built in the Eastern coal fields. However, new gas pools are discovered from time to time. For example, one has lately been found about nine miles southeast of Cherryvale, Kan., which promises to be of considerable importance. The conditions of this pool are perplexing, the gas sand being encountered at depth of 400 ft., and extending to depth of 500 ft. The initial rock pressure is about 280 lb. Wells have been drilled which have a volume of 15 to 30 million cubic feet.

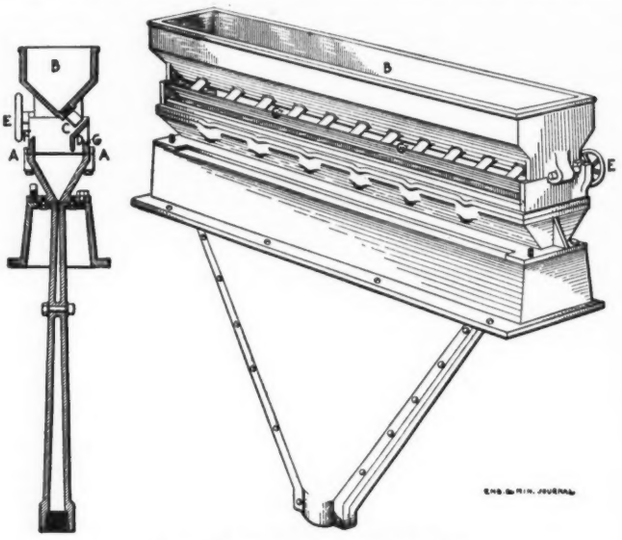
The Plumb Pneumatic Jig

BY EDWARD S. WIARD*

A new jig has recently appeared, the invention of A. M. Plumb, the striking characteristics of which are extraordinary capacity for the small screen area employed and lack of susceptibility to changes in the character and rate of feeding.

The machine has the general form of the hopper of a single-compartment Harz jig, and the body is made of cast iron. It has a screen area of but 3x24 in., and the overall dimensions are but little larger. It receives its pulsations from a rotating valve connected to an air-pressure supply system, the valve being similar to those on the Richards jig and classifier. The air is introduced from below, as is shown in the accompanying drawing.

In capacity the Plumb jig equals or exceeds that of a Harz for a unit of screen surface. In tests at the Bunker Hill mill, northern Idaho, the Plumb jig attained a capacity of 6 tons per day on material which had passed a 20-mesh but had failed to pass a 40-mesh screen. With this rate of feeding the jig was not unduly crowded. The power required for this service was 1.2 hp. For a feed finer than 40-mesh, the power consumption is estimated to be ½ hp. or less, the power required decreasing with the size of material treated. Screen area of the Plumb jig is 3x24 in., or ½ sq.ft., or the capacity per square foot of screen surface is 12 tons per day of 24 hr. The capacity of a Harz jig per square foot of the first compartment does not exceed 12 tons per day and for good work is probably much less.



THE PLUMB PNEUMATIC JIG

The screen of the Plumb jig is made up of two pieces of screen cloth, the upper or protective layer being 20-mesh, No. 24 wire, while the lower, which is the screen proper, is 150-mesh. The fines which accumulate in the hutch owing to imperfect screening can be removed at any convenient point at the lower part of the jig. It has been found by the inventor that with a constricted opening for the discharge of the hutch material it will be pushed out by the air pulses with very little loss of air. The opening for discharge of hutch is not shown in the draw-

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ings. Bolts for securing the screen-cloth pass through it at the points *A*. *B* is a hopper with feed pipes *C*, which play against the baffle *D*. By means of the handwheels *E*, at either end, the whole hopper can be moved sidewise, altering the space between the ends of the pipes *C*, and consequently the rate at which the feed will discharge upon the baffle *D*. The last is fixed; the clearance between it and the screen is $\frac{3}{16}$ in. Tailings discharge the whole length of the jig at the point *F* and concentrate the whole length at *G*.

The mode of feeding and discharging concentrates and tailings is in marked contrast to Harz-jig practice. It would be desirable to have a somewhat similar arrangement on Harz jigs if it were not that the escape of water on the concentrate side of the machine would be so heavy as to be prohibitive. Since the concentrate-discharge lip *G* is a fixed integral part of the jig, the latter cannot be adjusted so as to yield concentrates of any grade desired, as on a Harz jig, by raising and lowering the concentrate gate. If the Plumb jig had an adjustable concentrate-discharge lip it would have to be raised and lowered with great caution for the reason that owing to the greater freedom with which air passes through the interstitial passages formed by the grains composing the bed, a very slight disturbance in the balance of the concentrate and sand columns would cause all the air to pass up one column or the other. The inventor has found that a slight lowering of the concentrate column will cause all the air to pass out on the concentrate side of the machine, carrying the bed with it. An adjustable gate is almost impossible for the further reason that it could not be made to fit with sufficient perfection to prevent a heavy loss of air.

In order to obtain successively leaner grades of concentrates and middlings a number of the jigs would have to be run in series, the tailings of one feeding the one next below it. The concentrates discharged by the machine are always the richest material in it. On pure galena ores the concentrates contain above 80% lead. This action of discharging only the richest concentrates is not peculiar to the Plumb jig. On the Harz jig, if the adjustments be left alone, the discharges will ultimately yield only the richest material fed to any compartment, the same action which attains in the Plumb jig with fixed concentrate-discharge lip.

The Plumb jig is not affected by changes in the rate or grade of feeding. If the grade diminishes, the concentrate stops discharging or discharges more slowly, and the reverse action ensues when the grade becomes better. The same actions take place when the rate of feed is diminished or increased. The concentrate and sand columns adjust themselves instantly to a change in feeding. The older air jigs did not attain this perfection of balance under varying conditions because the freedom of the grains passing into them was interfered with by various mechanical devices. In the Krom air jig concentrates were removed below the screen by a revolving roller which could not accommodate itself to changes in the rate at which concentrate was made and an increase in the rate or grade of feeding sent concentrate into the tailing or the concentrate became too lean if reverse conditions ensued.

The Plumb jig requires closer sizing than a Harz, and when jigging grains above 12-mesh size, the air consumption is so heavy as to be prohibitive. Pulsations vary from 400 to 800 per minute.

One of the important uses to which the machine can be put is the removal, before or after tabling, of the rich grains which occur in the overlapping sand and concentrate bands from Wilfleys or tables of the kind. At the Bunker Hill mill, where the Plumb jig has been tried, results have been so striking that they may lead to profound modifications in the flowsheet. The advantages indicated from the test work are a large decrease in the tonnage of concentrate made and an increase in the grade, or a decrease in freight and treatment charges, and the production of middlings and sand tailings devoid of free rich galena.

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Rates on Lake Superior Ore

WASHINGTON CORRESPONDENCE

The Interstate Commerce Commission has decided to hold an important hearing at Duluth, probably on Dec. 16. Commissioner B. H. Meyer will take charge of it, and it will involve the iron-ore rates from the Mesabi range to Duluth, which have been in controversy for some time past. Up to about two years ago the rate on ore was 80c. over this route. Subsequent to the publication of the report of the Commissioner of Corporations on the Steel Trust, the railroads reduced the rate to 60c. This was done at the same time that the ore contracts with the Great Northern were given up. Apparently it was a concession to public opinion. The 60c. rate, however, was not satisfactory and it was decided to make a protest. This was filed with the Commission and it was supposed that action would be taken almost immediately. Recommendations were made to the Commission by investigators in favor of a 40c. rate. These, however, were not deemed to rest upon sufficient facts and consequently the whole matter was deferred to the future. It has been under investigation ever since and the hearing at Duluth is intended to give the ore-carrying interests an opportunity to submit evidence in favor of the 80c. rate, so as to place all the facts before the Commission. Frank B. Kellogg is expected to appear for the railroads and other counsel well known in transportation cases will also be heard. Subsequently the proceedings will be shifted to Washington and at an early date there will be other public hearings. According to reports current here, the Commission still has in mind the ordering of a 35c. or 40c. rate in lieu of the existing rate. It is not supposed that the change would alter the traffic of the roads affected in any material degree, so that the change would be equivalent to that amount of reduction in the revenue of the lines and consequently to a corresponding cut in their earnings. This it is supposed would directly affect the United States Steel interests, which control the lines in question.

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A Concrete Hardening Material now being introduced contains 95% iron dust or iron flour, which is mixed with cement for finishing the surface of concrete floors, says "Engineering News." From 15 to 25 lb. of the material is mixed with 100 lb. of the cement while dry, and one part of this mixture to two parts of sand makes the slush for the top coat, which varies from $\frac{1}{8}$ to 1 in. in thickness. It is said to make a hard and durable floor which is waterproof and not slippery. The hardening material is used also to make new concrete adhere to old concrete in repair work. This concrete hardener is made by the Globe Steel Co., of Mansfield, Ohio.

PERSONALS

Prof. A. L. Walker is down with typhoid fever.

Robert Linton will return to New York in January.

H. V. Winchell, who has been visiting in New York, has returned home. He will soon go to Colorado.

James A. Roberts and R. L. Dimmick, of Denver, recently visited the Frisco mines, in Mohave County, Arizona.

T. J. Purdy and J. E. White recently examined properties in the Cerbat and Todd Basin districts, in Arizona.

David J. Pullinger, of the Butters' Salvador Mines, Ltd., San Sebastian, Salvador, was recently in New York.

A. B. Richardson, who has been sampling the Bi-Metals mine for the Mines Co. of America, is in Kingman, Arizona.

George H. Garrey, who has been engaged in the examination of zinc properties in eastern Tennessee for Illinois parties, was in Chicago last week.

Frederick W. Horton, of the Denver station of the U. S. Bureau of Mines, recently visited the molybdenite mines of Copper Cañon, near Kingman, Arizona.

A. L. Horr has been made general manager of the Vulcan Manufacturing Co., Fond du Lac, Wis., which is strengthening its position in structural fabrication.

Lawrence Addicks, superintendent of the works of the U. S. Metals Refining Co., at Chrome, N. J., is leaving on Dec. 6 for a tour of inspection in the West, which will occupy him several weeks.

William H. Storms, former state mineralogist of California, who has recently been making examinations of mines in the Mother Lode region, has been appointed general superintendent of the West Eureka mine, at Sutter Creek, California.

Albert H. Fay, of the United States Bureau of Mines, is making a trip through Montana, Idaho and thence southward to Arizona. His object is to facilitate the collection of information about mine accidents. He will return to Washington about the end of December.

J. C. Merriam, professor of paleontology in the University of California, has obtained six months leave of absence to begin Jan. 1. He will spend the time in geological research. Dr. L. N. Stephenson, of the U. S. Geological Survey, will occupy Professor Merriam's chair during that time, as already noted.

A. E. Crockett, general manager of the Standard Chain Co., Pittsburgh, has resigned, to become connected with the Roanoke Refined Iron Co., which has leased for a term of years the Loucks plant, Roanoke, Va. The new company will make melting bar for crucible steel-works practice and high-grade refined iron bars.

J. E. White, former manager of the Quartette Mining Co., and R. P. Wheelock, superintendent of the Enterprise Co., have associated themselves together for the purpose of conducting a general engineering business in Mohave County, Ariz., with headquarters at Kingman, where they expect to open up an office with complete modern equipment.

Leslie H. Webb, secretary Wedge Mechanical Furnace Co., sailed for Europe Nov. 29, on the "Carmania." During his trip abroad, Mr. Webb will visit England, France, Germany and Sweden for the purpose of investigating the various metallurgical plants in these countries, in the interest of his concern. Mr. Webb expects to be absent for a period of about two months.

J. W. Hutchinson, mill superintendent and assistant general manager of the Goldfield Consolidated and consulting metallurgist of the Buckhorn Mining Co., is in the hospital at Reno, Nev., as the result of an accident on the Eureka & Palisade R.R., Nov. 21. A hand car, on which he was riding, struck a steer. He was thrown in front of the car, which then ran into him.

J. F. Thorn has ben appointed general superintendent of Butters' Salvador Mines, Ltd., with headquarters at San Sebastian, Department of La Union, Salvador. This office is a new one and is intended to relieve M. F. Perry, managing director for Charles Butters & Co., Ltd., who will spend part of his time in the United States as well as having general charge of the Butters' Salvador Mines, Ltd., Butters' Divisadero Co., and Butters' Potosi Consolidated Mines.

SOCIETIES

Old Freibergers in America—The next regular meeting of former students of the Freiberg Bergakademie will be held Dec. 20, at the Hofbrau Haus, Broadway and 30th St., New York. This meeting is the annual meeting and election of officers will take place. All former students of the old mining school should communicate with C. L. Bryden, 1701 Jefferson Ave., Scranton, Penn., the Secretary.

American Society of Mechanical Engineers—A special meeting was held at the Engineers' Club, in New York, on the evening of Dec. 3. The Grashof medal of the Verein Deutscher Ingenieure—the highest honor in the gift of that body—was presented to George Westinghouse, to whom the medal for this year has been awarded. This ceremony was followed by an address from John W. Lieb, Jr., on "Leonardo da Vinci—Engineer and Artist."

American Institute of Chemical Engineers—The sixth annual meeting will be held in New York, Dec. 10-13. The program offers papers on a considerable variety of subjects. One evening session will be devoted to welfare and safety in chemical works. A number of practical papers will be read and discussed. Visits will be paid to the American Museum of Safety and to the plant of the Sanitary Utilization Co., at Barren Island, where the garbage of Greater New York is disposed of. This, it is claimed, is the largest and best plant of its kind in the world.

American Electrochemical Society—The next meeting of the New York section to be held at the Chemists' Club, 52 E. 41st St., New York, on the evening of Dec. 12, will be a joint one with the New York sections of the American Chemical Society and the Society of Chemical Industry. Members of the Institute of Chemical Engineers have also been invited to attend. Dr. B. C. Hesse, of the American Chemical Society, will preside. The subject for the meeting is "Welfare and Safety Work in the American Chemical Industry," and the work done at various plants will be presented as follows: The New Jersey Zinc Co., Miss Florence Hughes, Palmerton, Penn.; The Welsbach Co., Howard Lynn; The National Lead Co., Charles P. Tolman; Harrison Brothers & Co., Inc., Dr. Francis D. Patterson.

Utah Society of Engineers—At a meeting held Nov. 21, an address on the "Water Supply of Salt Lake," was given by Sylvester Q. Cannon, city engineer. The chief sources of supply are City Creek, Emigration Cañon Creek, Parley's Creek and Cottonwood Cañon Creek. The fluctuation of the combined flow was shown by a chart, based on the minimum year on record. If Salt Lake acquires rights to water from all the mountain streams that feed the valley, builds reservoirs to store the surplus flood waters, and inaugurates a meter system, there will be an ample supply for a population of 660,000. The steps necessary for the construction of a storage system were explained, and mention was made of dams now being built at lakes near the head of Big Cottonwood Cañon. This work was shown by photos and lantern slides. Herman Harms, state chemist, read a paper dealing with the purity of the water. Few cities can boast of a better supply.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

PAPE PROCESS—Improvements in or Relating to the Extraction of Metals. Hermann Pape, Oker, Germany. (Brit. No. 22,715 of 1912.)

ZINC-LEAD ORE TREATMENT—Improvements in or Relating to the Treatment of Refractory Zinc-Lead Ores. P. C. C. Isherwood, Bushey Heath, Eng. (Brit. No. 22,855 of 1912.)

ZINC RECOVERY—Process and Apparatus for Recovering Zinc from Slags, Ores and Other Zinkiferous Materials. F. C. W. Timm, Hamburg, Germany. (Brit. No. 5438 of 1913.)

DRILL—Rock Drill. Charles A. Hultquist. Los Angeles, Calif. (U. S. No. 1,077,911; Nov. 4, 1913.)

DRILL-MAKING MACHINES FOR DIE. John George Leyner, Denver, Colo. (U. S. No. 1,078,295; Nov. 11, 1913.)

DRILL-SHARPENING MACHINE. John George Leyner, Denver, Colo., assignor to The J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,078,294; Nov. 11, 1913.)

DRILLING MACHINE. Frank Stevens and Frederick Spicker, Roundup, Mont. (U. S. No. 1,077,649; Nov. 4, 1913.)

MINE SHOVEL. John Cabbott Cartmill, Lead, S. D. (U. S. No. 1,078,255; Nov. 11, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Nov. 26

The Farmers' Fight Against the Mammoth will probably be renewed as the Shasta County farmers are reported to be preparing for a fight. For some time the farmers association has retained no legal counsel, but at a recent meeting negotiations are said to have been undertaken for retaining Charles H. Brainard and Theodore Bell. Brainard is the strongest man among the attorneys of Shasta County for this particular class of legal work, and Bell has a national reputation. So the farmers are fortifying themselves with the best legal talent available. It is evident that the farmers have reached the conclusion that if they are to be successful in a final effort to destroy the copper industry of Shasta County they must make a bold front and act promptly.

Relinquishment of Land to Government has been made by North California Mining Co. Land was in Plumas County and aggregated 100,000 acres, which has been surrendered to U. S. Government. Formal relinquishment and surrender has been filed with recorder of Plumas County. Company states that act is in accordance with its policy to segregate valuable and worthless mineral holdings and to relinquish title to latter. Number of claims relinquished totals more than 300. A number of these claims were known as the H. H. Yard claims. Yard was attacked in the courts a few years ago by Lewis E. Aubury, then state mineralogist. Aubury repeatedly charged that Yard was endeavoring to secure valuable timber lands for his company under pretense that they were mineral claims.

SALT LAKE CITY—Nov. 28

The Largest Lead Producer in Utah is the Utah Apex mine at Bingham. The annual report for year ended Aug. 31, 1913, shows operating profits of $224,774. Amount charged off to depreciation was $94,585, leaving a balance carried to profit and loss of $130,189. The report of President F. A. Schirmer calls attention to the fact that operations have been very encouraging, notwithstanding several unavoidable setbacks. Labor was scarce early in the year, following the Bingham strike, and operations did not reach normal until March. The output was held back at times by the smelters; 400 tons per day were shipped for a time, but the company was obliged to reduce shipments to 100 tons. Later an increase to 300 tons was made, and 100 tons were being shipped again at the time the report was written.

DENVER—Nov. 29

In the Coal Strike Governor Ammons has done his best to obtain a truce between operators and strikers. To this end he arranged for a conference between the two factions, Nov. 26, in which the union was to be represented by three miners and not by leaders, as it was thought that a meeting in which both sides would present their grievances and discuss them in a reasonable way, would do more toward wiping out misunderstandings, and reëstablishing peace than anything else that has been done. Object of meeting was to be either a settlement of the strike, or to declare a truce until next session of legislature when miners or operators may introduce such bills as they deem advisable. The operators and miners met at the State House for the first time after the strike was called two months ago. The result was disappointing. They wrangled all day and a half of the night without reaching any agreement, and adjourned at one in the morning without having taken any definite action. During the conference word was received of arrest by General Chase of E. L. Doyle, secretary-treasurer of the United Mine Workers for refusing to give information of whereabouts of McGrary, said to be an instigator of the plot to murder Detective Belcher a week ago. Miners then refused to go on with conference until Doyle was released, President Hayes, of the United Mine Workers, telegraphing Governor Ammons that he would call them out of the meeting unless this was done. So Governor Ammons wired General Chase to release his prisoner on grounds that peace was desired at any reasonable cost. The incident, however, showed clearly that the miners in conference were under the domination of their leaders. The release of Doyle by the governor's order, however, caused great dissatisfaction to the troops in the field, as belittling General Chase's authority and encouraging strikers. The committee of strikers had another conference with the governor the night of Nov. 27, and definitely refused to accept his suggestions, miners insisting on union recognition. Governor Ammons then sent Deputy Attorney-General Bouck to Trinidad with his order to protect the citizens of the state, preserve peace in strike district and enforce laws. This latter phrase is interpreted to mean that those wishing to go to work in the coal mines will be given the protection of militia. Meantime prices of coal are back to normal with plentiful supply and all danger of a fuel famine averted.

BUTTE—Nov. 24

The Shortest Railroad in Montana is 16 miles long, running south from Chestnut on the Northern Pacific R.R., 8 miles east of Bozeman, to the Maxey coal mines. The road was constructed in 1899 by George W. Turner, of Spokane, and his brother, Col. W. W. Turner, to open up the coal district south of Chestnut. The Northern Pacific R.R. operated the road on a lease, but the mines were not developed on a successful scale and the traffic gradually fell off until, two years ago the Northern Pacific refused to renew its lease. It was however, persuaded shortly afterward to again run temporarily, and continued until about six months ago, since which time no trains have been run. The Maxey mines employing 60 men, and the mines at Hoffman employing 40 men, have been closed down during this time. The road, which is now owned by Charles Garnier, of Livingston, and W. J. Johnston, of Lewiston, will soon be operated again on a lease by Maxey Bros., owners and operators of the Maxey mines, and Anderson and Evans, operators of the Hoffman mines, the Northern Pacific to furnish the rolling stock. The mines will be reopened at once and worked to full capacity.

CALUMET—Nov. 29

Lawlessness and Disorder prevailed in Keweenaw County to such a degree during the week that the supervisors called upon Governor Ferris to send additional troops; the small force being inadequate to patrol the district and maintain order. The situation is entirely beyond the civil authorities. An attempt was made Wednesday evening to destroy the large steel stacks of the No. 2 boiler house of the Ahmeek company. A charge of dynamite was placed on the concrete foundation but the damage done was comparatively slight; it only succeeded in breaking the windows in the compressor and boiler houses, which are close to the stack. Immediately after the explosion a fusilade of rifle shots was fired but no one was killed. Promiscuous shooting has been going on nightly; the houses of nonunion men have been hit and the bunkhouse and searchlight at Ahmeek were fired on. This outbreak started upon the arrival of two coaches of men imported for the Ahmeek. The men arrived at the property without serious trouble, but the continuance of disorder and rioting evidently has intimidation of those working as an object. An attempt was made to burn the residence of one of the Mohawk mine captains early in the morning. In the vicinity of Calumet and the South Range, the district has been comparatively quiet, with the exception of Wednesday morning, when parading strikers in Calumet became particularly abusive to men going to work and to mine guards. After the parade had broken up in front of the Western Federation headquarters, the officers arrested one of the men who had been particularly obnoxious. This started a general melée, in which a striker was shot by one of the mine guards. The guard had been knocked down and was being severely handled when he drew his revolver and fired two shots; one hit a striker going up the stairway into the union hall. Ahmeek started shipments to the mill Wednesday; about 600 tons were shipped. This was the first ore shipped from the mine since the strike started. Bunk houses are being built at the Allouez, Kearsarge and Centennial mines, and the Wolverine and Mohawk have let contracts for the erection of buildings for the men that will be brought in to work those mines. A change of venue has been granted and all strike cases that were called for the November term of the circuit court were deferred and will be tried in January in Baraga County. During the last few months hundreds of arrests have been made, but only a few convictions have been obtained, in which judgment was postponed and the guilty men allowed

to go on their own recognizance. The mining companies have announced an eight-hour working day for all underground employees and nine hours per day for surface men, to go into effect Dec. 1. The Calumet & Hecla has announced that on each Tuesday afternoon the general manager will meet any employee who has a grievance or a complaint to make; it will be investigated and no employee will be discriminated against.

BISBEE—Nov. 24

A Lead Furnace in the Warren District is still being considered by directors of Shattuck-Arizona, who have just returned to Duluth after a visit to the Shattuck mine. They will take up the subject at a future regular meeting. However, there is the possibility that others will provide a lead furnace with whom Shattuck-Arizona will be able to make advantageous contracts. It is presumed that this means either Calumet & Arizona or Copper Queen, both of which have large resources of lead-silver ores of their own, that they are not mining at this time.

NEGAUNEE—Nov. 29

Curtailments of Industrial Operations have taken place in the Lake Superior iron region within recent weeks. Some of these have been due to the action of the mining companies in putting their properties on a winter basis and are, as a rule, customary at the close of the season of lake navigation. But other curtailments have undeniably been due to the less favorable conditions noted in the iron and steel trade, and there is apprehension that further measures of the kind will be recorded. It is certain that much less ore will be mined during the winter than was indicated a few months ago.

Low Iron Prices and Slack Demand are causing Lake Superior furnace men considerable concern. Large concerns, refusing to sacrifice their iron on an easy market, are carrying large stocks. One of these is the Cleveland-Cliffs company, which is well stocked at its Marquette plant and which recently put its Gladstone furnace out of blast. The Lake Superior Iron & Chemical Co. is carrying comparatively small stocks, but this condition results from sales of a large tonnage at low prices in the last few months, incident to a reorganization of the company's affairs. Another thing that causes concern to the furnace men of Lake Superior is the practical disappearance of the differential between charcoal and coke iron. Within comparatively few years the iron makers of this district could base their calculations on a price for their product $2 better than the prevailing quotation for coke iron. But the day of such a substantial differential has passed for the time. Lately standard pig irons have been quoted at from $15.25 to $15.75. Charcoal iron sells at $15.75, but even at that price, and with the differential practically obliterated it is now pressing for sale. A differential of $2 should prevail, according to the charcoal-iron men, not only because of the superiority of their product, but because of its increased cost. The plant of the Stephenson Charcoal Iron Co., at Wells, Mich., is, however, not only sold up, but has refused orders. This fortunate condition is due largely to heavy orders from the Milwaukee railway, which has been gradually increasing its purchases of the company's iron for its car-wheel foundries. Among the first contracts closed when the Wells stack was put in blast about a year ago was one with the Milwaukee railway, and the company has been buying more and more. The iron is smelted with the specifications of the Milwaukee company particularly in mind, and no shipment from the Wells stack has yet been rejected. The last order from the Milwaukee road exceeded the company's capacity to deliver within the time specified. The Wells stack makes about 20,000 tons of pig iron a year.

PLATTEVILLE, WIS.—Nov. 26

Encouraging Developments, new types of mine equipment and good results in churn drilling mark the present situation. Where deposits prove small and yet profitable to mine, portable mills are built. These were introduced into the Platteville district by the Vinegar Hill Zinc Co. The hammer drill or water Leyner type are popular, being so well suited for drilling in limestone. A good strike was made at the Pittsburgh mine lately, a big body of ore was located near the shaft, though much water was encountered which is characteristic of the Galena basin. This company recently purchased the old Calvert mill at Benton, from the Vinegar Hill Zinc Co., and is moving it to its property. The mill is operated by steam. The Wisconsin Zinc Co., has opened the east end of the Winskell mine which is looking good. Two shifts are being worked there and at the East End mine near Platteville. Two drills are working near New Diggings, on the Champion property, and the results so far obtained are good. The Sans Souci Mining Co., of Benton, has proved up a body of ore and is now making arrangements for building a mill. The Vinegar Hill Zinc Co. has completed the mill on the Martin property near Benton. Conditions underground are good and the mill is treating a satisfactory tonnage. The Midland Lead & Zinc Co., of Platteville, reports a good strike on the 120-ft. level of its mine, near Elmo. This property was reopened last summer when considerable repair work was done on the equipment and new machinery, including two 60-hp. Fairbanks-Morse gas engines, was installed. The Enterprise mine has recently been unwatered and plans for developing the underground workings are under way. This company is drilling a nearby property, and as far as known, the results are favorable to sinking. The Empire roaster, at Platteville, is running two shifts and the plant is being operated at full capacity, roasting most of the ore for the East End mine and others.

DEADWOOD—Nov. 27

New Change House at Ellison Hoist of Homestake Mining Co., is described as one of the finest buildings of its kind ever erected. It has two stories, and is made of concrete and steel with perfect lighting, ventilation and sewerage. The interior dimensions are 40x80 ft. On the first floor are steel troughs, level with the window sills, on both side of the main room. The troughs are furnished with basins and soap, and equipped with 50 pairs of faucets supplying hot and cold water. At the rear on this floor are 8 shower baths, each compartment being 5 ft. square and provided with watertight lockers in which clothes may be placed at bathing time. Partitions and doors of these baths are of steel. In the northwest corner of first floor is a room 12x18 ft., provided for shift bosses. It is fitted up with showers, an enamel tub, lockers, chairs, mats, faucets, troughs and basins. In the main room are 186 steel lockers, large enough to accommodate two suits, shoes, lunch pails and other articles. Each locker is provided with individual keys. Leading to the second floor is a steel stairway. This floor is practically the same as the first, except that more space is given to lockers, there being 288, or a total of 474 in the building. Floors are of steel and concrete; heat comes from exhaust from hoisting engines.

COBALT—Nov. 24

The Bounty on Cobalt under the terms of the metal-refining bounty act, is 6c. per lb. on the metallic cobalt contained in cobalt oxide made in the Province of Ontario. During the last year, three companies received bounties amounting to $10,000, namely, Deloro Mining & Reduction Co.; Coniagas Reduction Co.; and Dominion Refinery. The term for this bounty provided in the original act was five years from April, 1907, but in 1912 the legislature extended the time for another period of five years. Provision is also made in the act for bounties on refined nickel, nickel oxide, copper and arsenic made from mispickel ores not carrying cobalt. With the exception of the cobalt oxide, no claims have as yet been presented for bounties under this act. The market for cobalt ores has been decidedly improved by the decision of one of the American smelters to recommence the treatment of these ores. Several of the mining companies have sold to this smelter, ore that has been accumulating for some time. The action of the American Smelting & Refining Co. in putting a 7% arsenic limit on cobalt ore was responsible for the curtailing of the market.

The Draining of Cobalt Lake Project has reached the point where an application has been made by the Cobalt Lake Mining Co. to Mining Commissioner T. E. Godson, to fix an order for service for the time within which several defenses from draining the lake are to be filed. No date has been fixed by the commissioner, but it was intimated that the case will be heard in Toronto in the early part of December. Plans for the proposed draining project have also been filed and these plans show extensive operations in the vicinity of Cobalt Lake, and other lakes in the same basin. At Short Lake a dam is to be built to make a reservoir of that body of water as well as Brief Lake. From Short Lake, a pipe line will be laid along the bottom of Cobalt Lake to a large reservoir which will be built when the lake is pumped dry. This reservoir will give a supply of water to the various mines which are at present dependent upon Cobalt Lake. For the town, the plans submitted by the company show changes which it will endeavor to prove are improvements on present-day conditions. From the reservoir, water will be supplied for fire protection, giving greater head than at present exists. The draining of the lake will also involve a new sewerage system. In the plans, nothing is mentioned regarding taking care of the tailings at present flowing into the lake from the Northern Customs, McKinley-Darragh and Nipissing mills. It is expected that the hearing will take considerable time as the proposed draining of the lake affects almost every one residing on or owning property tributary to the various lakes which are affected by the scheme.

THE MINING NEWS

ALASKA

TIN IN THE TANANA DISTRIST has been discovered by A. O. Anderson, formerly of Butte. Ore was found near Hot Springs and is said to assay all the way from $10 per ton up to $147.

BIG PLACER STRIKE has been made at Andreafski near St. Michael and quite a stampede has been on from Nome. First stampeders to return to Nome reported that pay has been found to extend five miles along creek. About 40 miners are in new diggings now.

CANYON CREEK HYDRAULIC MINING CO. (Seward)—Articles of incorporation have been filed.

ALASKA TREADWELL (Douglas)—November tonnage, 79,961; yield, $233,406 or $2.95 per ton; estimated profit, $135,005.

NO. 10 BELOW, PEDRO CREEK—One of the largest mining plants ever taken in to Pedro Creek is being taken there by James McPike for operations next season.

MURPHY & PERRAULT (Fairbanks)—Quartz property on Fish Creek has been taken over by E. McConnell, who will start work at once. A stamp mill will be built next spring if winter's work justifies it.

ALASKA FREE GOLD CO.—This property in Willow Creek gold camp has been consolidated with all claims on Albert Creek in new Matanuska placer fields by William Martin, who has option to purchase for $250,000.

MOTHER LODE COPPER MINES CO. (Kennecott)—Completion of 7000-ft. tramway extending from Marvelous claim on top of mountain down to McCarthy Creek is officially reported. Company has mined, sacked and brought down to McCarthy Creek 500 tons of 65% copper ore containing 18 oz. silver per ton. Permanent quarters on top of mountain near outcrop have been erected and mining operations will be carried on throughout winter with 30 men. Before next April there will probably have been mined and shipped about 1000 tons of ore. Ore now mined and piled at McCarthy Creek will be shipped to smelter at Tacoma, about Dec. 15 or just as soon as ice on McCarthy Creek is sufficiently solid to permit sledding.

ARIZONA

Gila County

BLACK WARRIOR (Miami)—Operations for four days were suspended because of impassable condition of roads.

ARIZONA COMMERCIAL (Globe)—Cutting station at 1300 level has been almost completed and shaft is rapidly nearing 1400 level, at which it is to be bottomed temporarily. Work on raise on seventh level has been discontinued for present. Water on 1200 remains unchanged. No work is being done on 1200.

MIAMI COPPER (Miami)—Production is at rate of 3100 tons per day and this rate will be maintained, with possibly a slight increase, until about July, by which time it is expected that capacity of mill will be increased to 4000 tons. All ore being concentrated now comes from under ground, stockpile having been entirely cleaned up early last month. About 2000 tons have been derived from blasting pillars between large shrinkage stopes in both northwest and southwest orebodies. In northwest orebody are five stopes 50 ft. wide, 400 to 500 ft. long, and ranging in height according to dip of capping, highest being 125 ft. All these are full of broken ore. Between them are pillars 50 ft. wide, which are now being blasted from sublevels, spaced 25 ft. apart vertically, beginning at top sublevel and working downward. Only enough ore is removed to allow for increase in volume of broken rock, so that when bottom of pillar is reached space formerly occupied by solid pillar will be filled with broken ore. The entire orebody then will have been broken, above 370-ft. level, and ore will be drawn down through raises to 420-ft., or haulage level, and trammed to shaft. It will be drawn off at uniform rate over whole area, allowing capping to settle evenly and gradually. Pillars in southwest orebody, which is one-third size of northwest body, are being attacked in the same manner.

INSPIRATION (Miami)—American Bridge Co. is making good progress with riveting ore storage bins, riveting being about one-half completed. On account of insufficient material to start work on headframes at main east and west shafts bridge company has laid off a number of employees until such time as steel is received and work commenced on headframe. Several No. 8 gyratory crushers to be shipped by Allis-Chalmers are now on road and as soon as received will be put in place, as everything at coarse crushing plant is now in readiness for installation of machinery. Crushing plant at Scorpion shaft has been in operation for last few days crushing waste hoisted through Scorpion shaft, which is being loaded into cars and hauled to concentrator machine shop and warehouse and used for filling in. As this job has now been completed, waste is again being used in fill between dormitory and railroad. Portable tent houses recently purchased by company are being erected in Webster Gulch. Machinery is rapidly being installed in new test mill. Four Hardinge mills are in place and motors are being installed. Rolls and other crushing machinery, together with flotation machine, are being placed, and shortly Wilfley and Deister tables will be set up. Pipe line from ranch well has not yet been connected nor is there any electric power in sight. Concrete pouring is in progress on two lower retaining walls for concentrator, and forms are now being made, for upper retaining wall. Company has ordered 32 Ingoldsby ore cars, which will soon be on road, and which will be used for hauling ore between Scorpion crushing plant and test mill.

Pima County

PHELPS, DODGE & CO. has been acquiring mining property in Old Hat district and a survey of a line to district has been made by El Paso & Southwestern. District is 26 miles north from Tucson. Faults in limestone, quartzite, gneiss and porphyry are well mineralized, carrying lead, silver and copper. Work to date has been confined to oxidized ores.

Pinal County

RAY CONSOLIDATED (Ray)—Present operations are at rate of 8000 tons of ore per day but it is expected that concentrating plant at Hayden will later be able to treat 10,000 tons daily. Effect of caving is being noticed on surface. Original Ray mountain has been lowered at least 50 ft. and subsidence is apparent over greater part of mine, including Ray Central property. Underground workings have made it necessary to protect mines from surface water, and a tunnel extending all way from Ray Central in Copper cañon, passing under two mountains and emptying into Amanda Gulch, has been cut. Diversion dam will be constructed across Copper Cañon, after which present road between Ray and Sonoratown will be abandoned. Dangerous places at mines have been fenced off, and conspicuous signs warn public of danger of passing over caving ground. Company has adopted 'safety-first' idea and management is paying prizes to any employee who will suggest practical way of adding to safety of mines. Accidents have been reduced to minimum as mines have reached productive stage.

CALIFORNIA

Amador County

FREMONT CONSOLIDATED (Drytown)—Increased mining and high grade of Gover ore form an encouraging outlook for continued profitable mining. Company pays regular monthly dividends of two cents.

JOSEPH FIGONE VS. BUNKER HILL MINING CO. (Amador City)—Plaintiff, as administrator of estate of brother, Domenico Figone, sues for $40,000 on account of death of Domenico, who was Aug. 18, 1913, struck by a timber that fell from a raise at loading chute.

WEST EUREKA (Sutter Creek)—This old mine is being re-opened by San Francisco and Seattle men. It was formerly known as the Last Chance and is west of Old Eureka, owned by Hetty Green. W. H. Storms, former state mineralogist, has been employed as general superintendent.

ORO WATER, LIGHT & POWER CO. (Oroville)—Dredging ground is being drilled on Amador County side of Mokelumne River. Company is operating two dredges in Calaveras County, one on Mokelumne and one on Calaveras River. If present prospecting warrants dredge will be installed in Amador County.

KENNEDY (Martell)—Three miners were killed on 3100 level by powder explosion at noon Nov. 17. A fourth man was badly injured, losing sight of one eye. The four men were working about 800 ft. west of main shaft. Two were sawing, others were coming away from powder drift. Blasting time was 3:30. Accident happened about 12:40. Men were disobeying rule which does not permit their going after powder until time for blasting. Place where men had been drilling is about 1000 ft. from end of drift in which powder was stored. There were 5½ boxes of powder in magazine during forenoon and after explosion there remained 4 full boxes and a few loose sticks. No accounting for cause of explosion has been made. One of the men who went for powder borrowed a knife for priming. After his death knife was found closed in his pocket. The 12x12 timber which was being sawed for a cap was on a truck about 30 ft. from powder magazine. It had been sawed about two-thirds through. Explosion broke it in two, and split it into splinters. Bodies of dead men were found about 20 ft. apart..

Butte County

THIRD ANNUAL FRUIT & MINING EXPOSITION in Butte County opened at Oroville, Nov. 24. W. P. Hammon, dredge operator and also largely interested in fruit growing on reclaimed dredged lands, officially opened exposition.

BUTTE LEDGE & MINING CO (Chico)—New company, capital $50,000, will engage in general mining, timber and building.

EMMA (Nimshew)—In opening up new ground that had been overlooked when mine was worked in early days by Nimshew Gold Mining Co., O. H. Rugh took out a nugget valued at $726.

Calaveras County

CALAVERAS COPPER CO. (Copperopolis)—Mine is reported closed down and ore teams that have been hauling to railroad at Milton have been taken off. It is believed closing down is only temporary.

Humboldt County

RED CAP (Eureka)—Development is being paid for by returns from arrastre. Work will continue during winter, with expectation that sufficient ore will be blocked out to warrant building mill. Tailings from arrastre are being stored and will probably be cyanided.

Inyo County

SWANSEA (Keeler)—It is intended to prospect mine further with tunnel to be started below shaft. Preparations are being made for work during winter.

COLORADO

Chaffee County

LOYAL CO.—Company owns Belle of Granite mine. Having by two years' development work demonstrated that there is a large quantity of medium-grade ore on hand, a 10-stamp mill with cyanide annex is now contemplated. A compressor and new hoisting plant will also be installed. Excavation for mill has been commenced. It is estimated there are 20,000 tons of $15 ore above third level. Carload of ore has just been shipped to Salida.

Clear Creek County

FRENCH FLAG—Mine has recently been unwatered and placed in working order.

JACKSON MILL—Plant at Idaho Springs has been leased by E. F. Gustafson, who is treating ore from Golden Edge property.

JOE REYNOLDS—A vigorous campaign of development will be commenced in near future. During last few months a force has been employed in cleaning out and retimbering many old workings and mine will soon be ready for operation. Some prospecting was recently done on fourth level with a diamond drill and results were sufficiently encouraging to justify driving a crosscut to open up and develop parallel veins. It is intention to operate part of property on company account and grant leases on rest. It is estimated that large quantities of low-grade ore will be made available for stoping by work now in progress. Working force will probably be increased to 50 men within next 30 days. R. B. Morton, of Idaho Springs, is part owner and manager.

Lake County

Mt. CHAMPION (Leadville)—Mill is running night and day treating 100 tons daily.

San Juan Region

SAN JUAN BUREAU OF MINES was organized at Silverton recently. Hinsdale, San Juan, Ouray, Dolores, San Miguel, Archuleta and Conejos Counties will unite for betterment of existing conditions.

BROWN MOUNTAIN SMELTER (Ouray)—This plant shut down for three weeks for repairs, has resumed operations with a good supply of ore.

Teller County

CRESSON (Cripple Creek)—Recently published report that Maggie mine had been purchased is denied. Maggie is under lease to Carl Johnson, the "Lucky Swede."

EL ORO (Cripple Creek)—Company has unwatered Eclipse mine which has been drowned for 10 years, and at 400 level a vein of 2-oz. ore has been found. An 11-drill compressor has been installed.

STRATTON'S INDEPENDENCE (Independence)—Regular production of 10,000 to 12,000 tons of ore per month is being kept up under a liberal leasing system, and dividends of $10,000 per month or 20% on capitalization are being paid.

IDAHO

Cœur d'Alene District

C & R (Burke)—No. 3 tunnel is in 1300 ft., and there is a good mineral showing in face. In No. 1 tunnel there is good carbonate ore blocked out. In No. 2 tunnel, 235 ft. lower than the No. 1 tunnel, there is a large quantity of galena ore, but no shipments have been made. This oreshoot, which is found in upper workings, should be encountered by going 400 ft. farther in lower tunnel at an increased depth of 360 ft. Tunnel will be driven throughout winter. A new compressor will be purchased in order to make it possible to work a larger crew.

MICHIGAN

Iron

RICHMOND (Cascade)—This, one of few open pits in Michigan, has stopped work for 1913, after shipping 137,000 tons of ore. It will be reopened in spring if iron market is favorable.

McDONALD (Crystal Falls)—All work ceased a short time ago, management believing it better to close down than to stock ore that might not find a ready market. Decision of state tax commission to tax all ore stockpiles has caused many operators to go slow about stocking ore that might remain at mines for several years.

YOUNGS (Iron River)—Shipping of stockpile was completed a few days ago, task being done in record time. There were 55,000 tons to be loaded and work was finished in less than two weeks. Two shovels were used. It is said that actual time consumed in loading all ore amounted to 13 full days, or 312 hours, an average of 150 tons per hour.

REPUBLIC (Republic)—Penn Iron Mining Co. succeeded in shipping all but about 25,000 of ore which it had in stock at Republic property. Little that remains is lean and not readily sold. Mine laid off about 50 men a few days ago when shipping stopped. There are now 450 men employed on two shifts, and no further curtailment in working force is looked for.

ATHENS (Negaunee)—Work of sinking shaft is progressing satisfactorily, but it will probably be over a year before task is completed. Shaft will have to be sunk to depth of over 2200 ft. as diamond drills showed ore to exist at a depth of 2800 ft. At that depth drill holes were lost, so it is now known what ore is below. Shaft is 17 ft. in diameter, being one of largest on range, and is now down about 70 ft., being 10 ft. in ore. It will be lined with concrete, and steel sets will be used to the bottom. Engine house is about completed, and installing of machinery will soon be commenced. Equipment will be a 20-drill Nordberg compressor and a Lake Shore Engine Works hoist. Both will be operated by electricity. Engine house stands on a hill, far above collar of shaft, and steel headframe is now in course of construction. When completed mine will be deepest on Marquette range and one of the best equipped in Lake Superior district.

MINNESOTA

Cuyuna Range

CUYUNA RANGE OUTPUT for 1914, according to careful estimates will range from 3,000,000 and 3,500,000 tons. The 1911 production was 147,000 tons; 1912, 318,000 tons, and 1913 will be somewhat over 850,000 tons. Next year's tonnage is estimated to be four times that of 1913. President J. M. Hannaford, of the Northern Pacific Ry., estimates that his road will have 750,000 tons, while President Pennington, of Soo Line, states that his road will haul 3,000,000 tons. Of present year's tonnage, 850,000 tons, Soo Line will have hauled 725,000 tons and Northern Pacific 125,000. O. W. Johnstone, in charge of the Soo Line's ore-traffic department, is preparing for at least 2,500,000 tons next season, of which amount Rowe mine, now stripping, is expected to contribute 800,000 tons. Cuyuna Range shipments over Soo Line during present season, to Oct. 28, amounted to 690,789 tons, as compared with 271,165 tons in 1912. The 1913 shipments are made up from following properties: Thompson, 47,652; Kennedy, 167,218; Armour No. 1, 105,086; Armour No. 2, 175,744; Pennington, 95,089; total, 690,789. The Northern Pacific tonnage of 125,000 tons (estimated) will com from the following properties: Cuyuna-Mille Lacs, 80,000; Cuyuna-Duluth, 25,000; Barrows, 15,000; Adams, 5000; total, 125,000. The Soo

CUYUNA-DULUTH IRON CO. (Ironton)—Total shipments for season approximate 10,000 tons.

ADAMS (Oreland)—Installation of electrical pump has been completed. Company buys current from Cuyuna Range Power Co.

BRAINERD-CUYUNA (Brainerd)—Shaft is over 65 ft. deep; boilers erected and surface plant all assembled. Shipments will be made before close of next season.

BARROWS (Barrows)—Mine has completed its order for 10,000 tons and is stockpiling; plans to produce 85,000 tons next year. Shipments were started in October this year.

DULUTH-BRAINERD MINING CO. (Ironton)—Shaft sinking continues. Northern Pacific is arranging to construct a spur to property from Ironton, a distance of several miles.

CUYUNA-MILLE LACS (Crosby)—Mine will make winter all-rail shipments to various places. Season's shipments were between 30,000 and 40,000, somewhat less than had been anticipated.

KENNEDY (Cuyuna)—It is reported that Northern Pacific interests have purchased fee to at least a part of the mine, and that future tonnage will be hauled via Northern Pacific instead of Soo Line as at present.

IRON MOUNTAIN (Iron Mountain)—Manganiferous iron ore is being hoisted daily. Stockpiling will continue throughout winter, or at least until Soo Line spur is completed in to property, at which time officials contemplate a trial shipment all-rail to some consumer.

Mesabi Range

RUDDY (Biwabik)—Shaft sinking continues. Considerable trouble has been experienced from quicksand, but has now been overcome.

EUCLID (Chisholm)—Dam built by Euclid Mining Co. to keep back waters of Longyear Lake, broke, Nov. 14. Dam was built four years ago and enabled pit to operate, but breakage has filled mine with water. Water in pit is now up to lake level, and great expense will be entailed if mine is to be worked again.

MISSOURI-OKLAHOMA-KANSAS

Joplin District

CALAMINE FROM AURORA, MO.—Last week brought more than $3000. Old Methodist mine produced 41,000 lb. of ore.

WILBUR LAND (Miami, Okla.)—Zinc ore strike in drill hole shows 20% ore.

WRIGHT LAND (Miami, Okla.)—Third strike on tract made this week by Daugherty & Apple.

CONGRESS (Radersburg)—A dry concentrator has been installed at this property.

ELLIS LAND (Joplin, Mo.)—Drilling is in progress, with ore in sheet formation found at depth of 116 ft. Land will be prospected thoroughly.

H. L. & S. CO. (Lawton, Kan.)—Concentrator has been started making second mill for this new camp. A rich deposit of zinc ore is being mined at a depth of 140 feet.

TEXAS MINING CO. (Thomas Station, Mo.)—Concentrator will resume regular operations this week, ground having been retimbered and placed in better condition. Three drifts are producing.

FOSTER & CO. (Neck City, Mo.)—After going through 12 ft. of solid limestone, free zinc ore is being taken out. Shaft is down to 120 ft. Drill cuttings showed ore at considerably greater depth.

GRANBY LAND (Joplin, Mo.)—Lease has been granted to W. L. Perry, who will build sludge mill to treat sludge ores from Blackberry, Grace, Montana and other properties of Granby company.

MARION B. (Joplin, Mo.)—Property is producing carload of concentrates weekly, good orebodies being found in new ground. Operations once were suspended after mine had been wonderful producer.

DALLAS MINING CO. (Carl Junction, Mo.)—Pumping plant is being installed, to permit of operations below present level. Tests to determine extent of ore formations penetrated by drill are in progress.

DIPLOMAT MINING CO. (Galena, Kan.)—Greatest strike in years made by this company on Galena Lead & Zinc Co.'s land. Drill went into ore at 42-ft. level, continuing 15 ft. and still in ore when day's operations ceased. Cuttings run 30% zinc. Strike in virgin territory.

MONTANA

Butte District

A CONTRIBUTION TO MICHIGAN STRIKE FUND amounting to $10,000 was forwarded last week by Butte Miners' Union to striking miners in Michigan, bringing total amount contributed up to date to $41,000. This is exclusive of many thousand dollars raised and forwarded by other labor unions in Butte.

A MONUMENT ON GOLD CREEK is proposed, movement being on foot to erect the monument at spot where Granville Stuart, of Butte, discovered first gold on May 2, 1858. Discovery started rapid development of mining industry in Montana, which is chiefly responsible for present remarkable prosperity of state. Stuart is now librarian of Butte public library.

BUTTE & SUPERIOR (Butte)—Bond for $75,000 was filed with clerk of court by manager to comply with decision rendered recently by Judge Bourquin in suit brought by Minerals Separation Co., of London, against Butte & Superior. Filing of bond and of a monthly statement of operations has been ordered by court to prevent closing of plant and to secure plaintiff, in case its contention is upheld by a higher court.

BUTTE & LONDON (Butte)—A new 425-hp. Nordberg electric hoist has arrived at Butte, and will be put in place at once by Rainbow Lode Development Co., which is preparing to sink shaft at this property from 1100 to the 1600 level, preparatory to developing claim by crosscutting north and south to end lines. The foundations for the hoist are nearly completed, and unwatering shaft will probably be commenced Dec. 15.

BUTTE CENTRAL (Butte)—It is rumored that Boston officials owning defunct Ophir mine at Butte are contemplating a reorganization of company. Capitalization of the new company is to be $75,000, with sufficient money in treasury to pay off all outstanding debts and carry on operations on profitable basis. This basis, it is understood, will be for the present operation of mill as a custom plant for treating argentiferous ores from Butte and other mines, while mine is to be developed by lessees, earnings from mine and mill to be used for prospecting below 500-ft. level, where it is expected copper will be encountered.

NORTH BUTTE (Butte)—During first week of November directors awarded to Westinghouse Electric & Manufacturing Co. contract for what will be largest electric hoist in America, and one of the largest of its kind in the world. The Ward-Leonard system of control will be adopted. Hoisting drums 12 ft. in diameter will be driven by direct-connected electric motor running at 71 r.p.m. Power will be supplied to this motor from a motor-generator set equipped with a 50-ton Ilgner flywheel. Hoisting will be done in balance, but may also be done unbalanced. Skips will have a capacity of seven tons of ore. Round rope 1⅝ in. in diameter will be used and hoist is designed for normal rope speed of 2700 ft. and maximum of 3000 ft. per min. The hoist will be installed at new Granite Mountain shaft which at present is rapidly approaching 2800-ft. level. Hoist will raise 300 tons per hour from 2000-ft. level or 200 tons per hour from 4000-ft. level. The flywheel will be encased in steel housing and provided with self-lubricating bearings. Hoisting motor will be of type used in steel mills and will be of a heavy construction. Electrical equipment alone will weigh in excess of 250 tons. Special safety devices included in equipment, include electrically released brakes; automatic slow-down devices to prevent overwinding and a special controller to limit speed when hoisting men. Maximum rating of motor is 4500 hp.

ANACONDA (Butte)—Extensions of all ore bins at Butte mines of this company are nearing completion. Capacity has been nearly doubled, permitting storing 50,000 tons of ore, awaiting shipment to smelting works at Great Falls and Anaconda. This will obviate shutting down mines in future, when for any reason works are temporarily incapacitated to take their full quota of ore. This happens sometimes in severe winter weather due to freezing of ore in cars during transit, which prevents their being unloaded upon arrival at works. New bins at Belmont mine are built of steel and concrete. Steel for construction of new slime plant has arrived and is being put in place upon concrete foundations. In new leaching plant, sponge iron made from ore containing iron pyrites is being tried out as a precipitant in place of scrap iron. Experiments are also being carried on at smelting works with Cottrell smoke process, by which all solid particles in fumes are precipitated, only gases being allowed to escape. This will tend to do away with smoke suits in future. Development work at Nettie mine, recently taken over by Anaconda company is proceeding rapidly. It is proposed to sink shaft to 2000-ft. level to open old silver belt west of Big Butte, which in years past furnished thousands of tons of rich silver ore. Process of treating similar ores at Butte Central mill, has proved successful, and it is likely that this treatment, consisting of concentrating, followed by cyaniding, will be applied to Nettie ores. West Stewart mine in heart of city, was closed Nov. 22, and will probably remain down for two or three months. Hoisting engine and machinery will be overhauled and placed in good condition; shaft will be retimbered in a number of places where heavy shifting ground has thrown it out of alignment; and work upon addition to ore bins will be completed. About 475 men have been employed at the mine and most of these have been laid off during shutdown. Output of mine was about 600 tons per day. Berkeley mine, which has been closed during last two months for repairs, will be in readiness for operations within a few days, so men laid off at Stewart will be given work at Berkeley.

Broadwater County

RADERSBURG DISTRICT mines being owned chiefly by Butte men, Butte is much interested in report of renewed activity in that camp. This is due to prospects of a railroad soon entering camp and connecting it with outside world.

BLACK FRIDAY (Radersburg)—One of the men interested in this mine has succeeded in raising money in St. Paul for resumption of operations. It is expected that work will commence about first of year.

NEVADA

Churchill County

SEVEN TROUGHS COALITION (Seven Troughs)—Ore has been discovered 50 ft. below 1000-ft. level by diamond drilling, and has been opened by 250-ft. crosscut. Drift has been driven 15 ft. on vein. Walls of shoot, width and assays same as shoot on levels above.

Humboldt County

SILVER ORE NEAR RYE PATCH has been discovered, according to reports from Rock Creek.

OREANA MINING & MILLING CO. (Lovelock)—Company has filed articles of incorporation at Lovelock.

BALDWIN (National)—High-grade gold ore, it is stated, was struck recently on this lease in White Rock tunnel.

Lyon County

EMPIRE-NEVADA (Yerington)—Churn-drill prospecting is to be done. One drill is on the ground.

BLUE JAY (Yerington)—A diamond drill will be installed at once in order to prospect to greater depth.

SMITH VALLEY MINES CO. (Smith Valley)—A 60-hp. gasoline engine, 6-drill compressor and 25-hp. hoist have been purchased and will be installed at once.

WABUSKA COPPER (Yerington)—Oreshoot cut at depth of 135 ft. will be developed at once. Levels will be run off at intervals of 100 ft. from the 480-ft. shaft. Electric power for hoisting, compressing, etc., will be obtained from Truckee River General Electric Co.

MASON VALLEY MINES CO. (Thompson)—Ore receipts at smelting plant for week ended Nov. 20, 1913, were as follows: From Mason Valley mine, 1989 tons; from Nevada-Douglas, 1203 tons; from other mines, 732 tons; total, 3924, or a daily average of 561 tons. During same period three cars of matte were shipped. Seventh quarterly report for period ended Sept. 30, 1913, shows: Mason Valley mine ore produced, 25,986 tons; smelter treated, 47,455 tons; matte produced, 2947 tons; refined copper, 2,707,719 lb. Financial statement: Gross operating profit, $33,187; less depreciation, $28,296; deferred charges, $3645; bond interest, $14,040; total deductions, $45,980; net deficiency for quarter, $12,793.

Mineral County

GOLD IN SONOMA PASS near Sweetwater has been discovered. A 10-ton lot of high grade is ready for shipment.

THORNDYKE-BLEY MINING CO. (Sunland)—Mill is nearing completion and will be in operation at an early date. Recent development has been satisfactory.

AURORA CONSOLIDATED (Aurora)—The 500-ton mill is now under cover and is expected to be ready for operation by Apr. 1, 1914. Force of 150 men now employed at mine and mill. Company houses have been built and club house is under construction. Machine and blacksmith shops, warehouse and assay office are completed. Main tunnel is in 3200 ft. Other development is progressing satisfactorily.

Nye County

NEVADA CINNABAR CO. (Ione)—New electrical machinery will be installed. Plant is expected to be in operation early in 1914.

WAR EAGLE MILL (Manhattan)—Ample water supply is now being obtained from Big Four shaft by using return system in mill. It is reported that high recovery of gold is obtained on battery and tube mill plates.

Ormsby County

A TAX ON PLASTER will be charged after Jan. 1, 1914, according to recent decision of tax commission at Carson City. No tax has previously been charged on gypsum products.

NEW MEXICO

Eddy County

HARTFORD OIL & DEVELOPMENT CO. (Carlsbad)—This company is operating nine miles south of Carlsbad, and has purchased a complete well drilling outfit which arrived a week or two ago. Geologists have advised drilling in the lower Pecos Valley.

OREGON

Baker County

BELMONT (Greenhorn)—Rich ore has been encountered at depth of 90 feet.

CORNUCOPIA (Cornucopia)—Two tube mills and cyanide plant treat 100 tons of ore per day.

VIRTUE (Virtue)—Capacity of cyanidation plant has been increased, and more leaching tanks have been installed.

BONANZA (Greenhorn)—Thirty-stamps will drop all winter on good milling and concentrating ore. Much development is being done in mine.

HIGHLAND MINES (Rock Creek)—New machinery has been added. Treatment includes amalgamation and concentration. Equipment now consists of 1 Dodge crusher, 2 rolls, 1 Wilfley table, 1 Bartlett table and 7 Deister tables.

Clackamas County

OGLE MOUNTAIN (Elkhorn)—This mine, which has been idle for sometime, will soon be reopened and new machinery installed. Present equipment consists of a crusher and a 10-stamp mill. It has been idle on account of litigation which has now been settled.

Curry County

LUCKY BOY (Marial Post Office)—This mine, now idle, will be reopened soon under new management and it is understood that the small plant will be enlarged.

Jackson County

GOLDEN FLEECE (Ashland)—Property has been bonded to a company which plans building a mill.

SOUTH DAKOTA

Lawrence County

BISMARCK (Flatiron)—Company has published a letter in local papers, offering to give Wasp No. 2 company, which recently suspended on account of water shortage, about 120 tons of water daily, as Bismarck has about that excess over its requirements. This supply would be sufficient for the Wasp operations. It could be pumped to Wasp storage tanks at a nominal cost.

MOGUL (Bald Mountain)—Superstructure of new mill of this company has been completed, and machinery is now being erected. It is hoped to have plant running in January. Treatment will be fine grinding in cyanide solution, and continuous decantation, with Dorr thickeners, using countercurrent solution system. Unless it is found to be necessary, no filter will be used for slime, but it will go to dump as discharged from last thickener.

HOMESTAKE (Lead)—Announcement is made that bonus of 7% will be paid to employees at end of year, same as was done last year. Bonus will apply to regular employees, and will be paid in January, accompanying pay checks for December. With installation of new hoist at Old Abe shaft, cages will be replaced by skips for ore hoisting. This will be first of Homestake's shafts to be so equipped. Shaft is now 1400 ft. deep, with five compartments. Sinking is to be undertaken at Belt Development property, south and west of Ellison shaft, and machinery to be used is now being installed. Company recently purchased this property from owners, who had done considerable work, but failed to find ore, which is supposed to be at a greater depth. A large addition is being constructed at company's assay office, to relieve congestion of crowded quarters.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Nov. 14 amounted to 145 cars; those for week ended Nov. 21 to 159 cars.

GRAND CENTRAL (Robinson)—Large ore reserves are reported assaying $7 per ton in copper, silver and lead. The best showing is on 2000 level.

Salt Lake County

CAYENNE PEPPER AND SULPHUR were burned early this week to fill upper workings of Utah-Apex mine with smoke to drive out armed Mexican murderer who had sought refuge in workings and who had killed six men.

Summit County

SILVER KING COALITION (Park City)—Work on large underground station in Alliance tunnel is progressing steadily. A hoist and compressor will be installed, and operations carried on from there to reach large ore reserves in Alliance section of property.

Tooele County

SALT LAKE & MERCUR R.R.—Material from this company's road including 30-, 40-, 45- and 52-lb. rails, ties, miscellaneous tools, and machinery, and two Shay locomotives are being sold at receiver's sale.

INTERNATIONAL SMELTING & REFINING CO. (Tooele)—During early part of year company's operations at Tooele works suffered somewhat as a result of labor strike, but operations are now back to normal. Copper-smelting department at this plant has not been up to expectations, but it is understood that situation has shown improvement, and that number of custom shippers is increasing. Lead-smelting business at Tooele has been satisfactory. Last of new lead furnaces to be built was placed in commission early this autumn, and entire plant is now operating at capacity. These furnaces are rated at 250 tons daily, giving a total capacity of 1250 tons. Outlook for lead ores is said to be favorable, and judging from numerous contracts which have already been made, it would not be surprising if a further addition to this plant would have to be provided in future. During year new lead refinery at East Chicago, Ind., has been handling all lead bullion produced. At Raritan refinery enlargements which were under way have now been completed, giving plant a capacity of over 400,000,000 lb. of copper per annum..

WASHINGTON

Okanogan County

ORE PLACER—Company has started operations on its placer claims at Rich Bar, near Canadian boundary.

Stevens County

IRON CAP (Chewelah)—Preparations are being made for operations throughout winter. Work will be confined to 200-ft. tunnel.

ADMIRAL (Valley)—Company has been incorporated with T H. Greenway, president. Considerable work has been done.

CANADA

British Columbia

BRITISH COLUMBIA COPPER CO. (Greenwood)—Engineers have been investigating power possibilities of Whipsaw Creek, tributary of Similkameen River, opposite Copper Mountain, and about 10 miles from Princeton. Company has made its third payment on its option on Eureka group of claims near Nelson, and has also put a force of men at work on its property in Wellington Camp, near Phoenix.

CONTINENTAL DEVELOPMENT CO. (Butte, Mont.)—This company, holding a two-year lease on upper workings of Rocher de Boule mine, Hazelton, has started to equip property with machinery. D. J. Williams, formerly assistant superintendent of Pittsmont mine and smelting plant at Butte, will be manager, with F. W. Cochrane as electrical engineer. Williams states that there are upward of 10,000 tons of shipping ore in sight in upper workings of Rocher de Boule.

GRANBY (Grand Forks)—Reports from Hidden Creek mine indicate that construction work is proceeding rapidly and management believes that everything will be in readiness to blow in new works by Jan. 15. All buildings are roofed over with exception of sampler and all work has been put under cover. Arrival of boats with additional machinery required is reported, and blast-furnace construction will now be pushed to completion. Converter flues are in place. Crushing machinery is up and smelter stack 135 ft. high is well along and will be completed in two or three weeks. In other departments, work is equally advanced, hydro-electric plant is nearly finished, and Pelton wheels and generators are being set in place. Railway between mine and smelter and coast is finished and arrival of two locomotives and a number of ore cars is reported.

Ontario

LA PALME (South Porcupine)—A meeting of shareholders will be called shortly to ratify a by-law, permitting directors to sell property.

DOME LAKE (South Porcupine)—At a meeting Nov. 28 shareholders ratified proposal to sell 205,000 shares, which is balance of treasury stock, to Timiskaming & Hudson Bay Mining Co., at 17½c. per share. This block of stock, together with 200,000 shares, formerly purchased from General Assets, gives Hudson Bay company control of property.

JUPITER (South Porcupine)—P. A. Robbins, manager for the Hollinger a short time ago, made an examination of this property at request of a number of large shareholders and it is stated that his report did not bear out figures given by company's engineer. Mine, which was being financed by the Drummonds, has been closed down for some time on account of insufficient funds.

MEXICO

Baja California

IN THE SAN ANTONIO DISTRICT mining interests are more active than they have been for some time, and outside influence is decidedly marked by number of new denouncements.

MINAS DEL TRIUNFO (Triunfo)—Amalgamation of Progreso Mining Co. with Compañia Metalurgica de la Baja California, has made a great improvement regarding output, and when new power plant of 400 hp. is completed, results will be excellent. Suction-gas engines drive electric generators. Power will be distributed to various properties of company to drive hoists, pumps and old plant at Triunfo. This company has large and valuable holdings, and many of the properties are big producers.

SAN JUANES REDUCTION CO.—Roasters have been started up in full blast. Besides cyaniding roasted product a quantity of oxidized ore is being treated. Many mines of this company have a fine showing and ore reserves are considerable. At present "Parral" mine is producing greater portion of sulphide ore for roasters. This ore is being successfully hauled from mine to plant in a 5-ton Pierce-Arrow truck. Hardinge mill that was installed lately to regrind oversize from rolls is proving a success. Two large masonry tanks for leaching have been added to increase capacity of plant.

Neuva Leon

AMERICAN SMELTING & REFINING CO. (Monterey)—All smelting plants in Mexico will probably be shut down as a result of governments demands for funds to maintain army.

COLOMBIA

LORD COWDRAY RELINQUISHED CONCESSION of oil territory Nov. 26. He took this course, he said, because of political feeling that had been engendered by negotiations. The concessions sought from Colombian government apparently would have given Pearson concern indiscriminate right to construct harbor works and canals in connection with exploitation of Colombian oil deposits.

SOUTH AFRICA

PREMIER MINE—Three natives were killed and 22 wounded, Nov. 24, by police during a riot. Of 22,000 natives employed, 5000 got out of hand, looted stores, and attacked natives of another compound. Police were unable to disperse them, and fired two volleys before they could succeed in getting negroes to return to their habitations.

ANGOLA

BENGUELA RY. CO.—The railroad reached a point 520 km. (323 miles) measured along completed railway from Port of Lobito, Sept. 23. Railhead is now at an altitude of 6000 ft. above sea level, and railway follows summit of "Great Divide," watershed of Congo and Zambesi Rivers. As railway climbs up from sea level to plateau, a section of about 3 km. at 1 in 16 is fitted with a rackrail. For rest of line maximum gradients of 1 in 50 and curves of 100-m. radius have been adopted. Gage is 3 ft. 6 in. Line is now completed and fully equipped with rolling stock of uptodate South African standards for nearly half distance to Congo frontier, near Lake Diloto. It will there form an end-on junction with railway being constructed by Belgians through Elizabethville, Kambove and Ruwé, serving copper fields of Tanganyika Concessions Co.

CHOSEN

ORIENTAL CONSOLIDATED—October production $144,137 from 27,178 tons of ore. A dispatch dated, Nov. 28, states: During latter part of October we had a couple of light showers, which have enabled us to keep mills running up to date, but country is still dry, and unless we get heavy rains soon, we shall not be able to keep all stamps dropping during winter. Okura & Co. have completed their power plant, and commenced giving us a supply of electric power, Nov. 2, starting with Tabowie mill. This mill is now driven by Okura's power, as is Maibong mill, and all of machinery at Charabowie mine, with exception of surface hoist, on which we are training the Koreans to do electric hoisting. We shall operate Tabowie and Taracol mine pumps on Okura's power in three days from now, and expect to drive all plants at Taracol camp on Okura's power some time next week. Delay at Taracol camp is occasioned by one of Okura's transformers breaking down during 50% overload test.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Dec. 3

The metal markets have been variable and rather uncertain, but the general tendency seems to be a declining one.

Copper, Tin, Lead and Zinc

Copper—During the last week the market has been dull, weak and without any special feature. The little increase in activity that we reported at the end of the previous week proved to be only a flash, which did not amount to much anyway. Since then consumers both in this country and in Europe have continued to hold aloof, and the impression is beginning to prevail that on account of the decrease in consumption the statistical position is becoming worse and that a lower level will have to be reached before buyers will be interested in resuming purchases. Some small quantities of electrolytic copper were sold on Nov. 28 and 29 on the basis of 14½@14⅝c., cash. Since Dec. 1 there have been some small transactions—100,000 lb. lots—at 14½c., delivered, usual terms, and few points lower. Metal has been offered quite freely at such prices.

The Lake copper situation remains quite unchanged and quotations are purely nominal. In casting copper also the situation remains unchanged—a relatively large accumulation of stock and free offers to sell at concessions.

At the close we quote electrolytic copper in cakes, wirebars and ingots at 14.25@14.35c. Casting copper is quoted nominally at 13.95@14c. as an average for the week.

The London standard market on Thursday, Nov. 27, was £66 17s. 6d. for spot and £65 12s. 6d. for three months. On Nov. 28 it declined 5s., and on Monday, Dec. 1, developed considerable weakness, declining £1 5s. On Tuesday it reacted a little, spot going to £65 15s. and three months to £64 10s., and on Wednesday, Dec. 3, it closes at £65 12s. 6d. for spot and £64 5s. for three months.

Base prices of copper sheets on Dec. 1 was reduced 1¾c. and is now 20¼c. per lb. for hot rolled and 21¼c. for cold rolled. Full extras are charged and higher prices for small quantities. Copper wire is 16@16¼c. per lb. carload lots at mill.

Copper exports from New York for the week were 8105 long tons. Our special correspondent gives exports from Baltimore at 138 tons for the week.

Visible Stocks of Copper in Europe on Nov. 30 are reported as follows: Great Britain 11,990; France, 2490; Rotterdam, 2500; Hamburg, 1780; Bremen, 990; other European ports, 1050; total, 20,800 long tons, or 46,592,000 lb.; an increase of 610 tons over the Nov. 15 report. In addition to the stocks above, 2050 tons are reported afloat from Chile and 4950 tons from Australia, making a total of 27,800 tons.

Brass Prices have been fixed as follows, dating from Dec. 1: Sheets, high brass, 16c. net lb.; low brass, 17⅞c. Wire, high brass, 15¾c.; low brass, 17⅞c. Rods, high brass, 15¾c.; low brass, 18⅝c. Angles and channels, 20½c. Tubes, 20½c. for brazed and 20½c. for open seam. Scrap allowances are 10½c. net per lb. for high brass, and 11⅞c. for low brass.

Tin—Statistics for the month of November showed a considerable increase in stocks, and this fact induced the leading bears in London to attack the market. A very weak tone developed, and prices gave way easily. Sellers in this market followed closely the lead of London, but due to an almost entire absence of demand were unable to effect business. The close is somewhat steadier and firmer at £177 5s. for spot, and £178 2s. 6d. for three months, and about 39c. for December tin here.

Visible Stocks of Tin on Nov. 30 are reported as follows: London, 7246; Holland, 2505; United States, excluding Pacific ports, 4719; total 14,470 long tons, an increase of 2613 tons during November.

Straits shipments of tin in November are cabled as 5560 long tons, a decrease of 40 tons from last year.

Lead—The market is quiet and weak. The demand is poor and there is some pressure to sell. On Tuesday, Dec. 2, the American Smelting & Refining Co. reduced its price to 4.10. At the close New York is quoted at 4.05@4.10c., and St. Louis at 3.90@3.95 cents.

The London market is also weaker, Spanish lead being quoted at £17 10s., and English lead 2s. 6d. higher.

Spelter—On Nov. 28 and 29 some moderate transactions occurred at 5.05@5.10c., with one reported at 5⅜c. Since then there has been pressure to sell and a sharp decline in price, with the market decidedly weak. Buyers are believed to be not well covered, but such as have to buy pursue a hand-to-mouth policy. The principal consumer does not figure in the market at all. On the other hand stocks at smelters' works are increasing. There has been some pressure to sell and offers of tonnages at diminishing prices. At the close we quote St. Louis at 4.90@5c. and New York, 5@5.05 cents.

The London market is slightly lower, good ordinaries being quoted at £20 12s. 6d., and specials at £21 10s. per ton.

Base price of zinc sheets in carload lots is $7.50 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS

NEW YORK

Nov.-Dec.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
27	.....	...	.....	.....	...	.....	.....	.....	.....
28	4.8510	57⅞	*15	14½	39⅜	4.20	4.05	5.20	5.05
			@15¼	@14⅝		@4.25	@4.10	@5.27½	@5.12½
29	4.8520	57¼	*15	14.50	39⅝	4.20	4.05	5.20	5.05
			@15½	@14.60		@4.25	@4.10	@5.25	@5.10
1	4.8500	56¼	*14½	14.30	39¼	4.10	4.00	5.10	4.95
			@15	@14.35		@4.20	@4.05	@5.20	@5.05
2	4.8535	57⅜	*14⅝	14.25	38¾	4.10	3.95	5.10	4.95
			@15	@14.35		4.05	3.90	@5.15	@5.00
3	4.8545	57½	*14¾	14.25	39	@4.10	@3.95	5.05	4.90
			@15	@14.35				@5.15	@5.00

*Nominal.

The quotations herein given are our appraisal of the market for copper, lead, spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

Nov.-Dec.	Silver	Copper				Tin		Lead		Zinc	
		Spot		3 Mos.	Best Sel'td	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
		£ per Ton	Cts. per Lb.								
27	26⅛	66⅞	14.53	65⅛	71⅛	180½	181¾	18⅜	3.99	20⅜	4.48
28	26⅛	66⅝	14.47	65⅛	70⅞	180⅜	181⅛	18¼	3.97	20⅛	4.51
29	26 7/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	25 11/16	65⅜	14.20	64⅛	70	178⅜	179⅜	18	3.91	20⅛	4.51
2	26⅛	65⅞	14.28	64⅛	70	176½	177½	17⅞	3.86	20⅛	4.51
3	26⅛	65⅛	14.26	64⅛	69⅞	177⅛	178⅛	17½	3.80	20⅛	4.51

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latte being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

German Imports and Exports of metals other than iron and steel and the precious metals, and of ores other than iron, are reported as below for the nine months ended Sept. 30, in metric tons:

	Metals		Ores	
	Imports	Exports	Imports	Exports
Gold and silver	.....	.....	1,559	1
Copper	193,785	81,845	19,876	18,669
Tin	10,693	7,763	14,802	.....
Lead	64,187	45,304	104,479	3,699
Zinc	43,120	94,991	236,467	30,174
Nickel	2,381	1,687	9,364	.....
Aluminum	10,902	6,539	.....	.....
Minor metals	1,384	15,665	21,728	9,186
Chrome ore	.....	.....	20,811	383
Pyrites	.....	.....	809,086	22,913

Exports of metals include alloys and manufactures of the several metals. Imports of slag and slag products of all kinds were 998,707 tons; exports, 123,745 tons.

Other Metals

Aluminum—The market continues dull, with light sales and moderate demand. Quotations are still uncertain and rather weak. We quote 18¾@19¼c. per lb. for No. 1 ingots, New York. The foreign market is quiet.

Antimony—The market is quiet, with moderate business only. Quotations show little change. Cookson's is 7.50@7.60c. per lb.; Hallett's, 7.25@7.35c.; while 6.25@6.50c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—Demand continues fair and prices are steady. New York quotation is $39@40 per flask of 75 lb. San Francisco, $39 for domestic orders and special terms for export. London price is now £7 10s. per flask, with £7 5s. quoted from second hands.

Bismuth—Quotations at New York are $1.72 per lb. for metal produced from domestic ores; $1.80 for imported metal. London quotation is 7s. 6d. per lb. The price is controlled by the European syndicate.

Cadmium—German quotation is 750 marks per 100 kg.—equal to about 81c. per lb.—f.o.b. works in Silesia.

Nickel—Quotations for ordinary forms, shot blocks, or plaquettes are 40@45c. per lb., according to size of order and quality. Electrolytic nickel is 5c. per lb. higher.

Selenium—For large lots, 100 lb. or over, $3@3.25 per lb. is quoted; while $5 per lb. is paid for retail orders. Exports from Baltimore for the week included 882 lb. selenium to Hamburg.

Gold, Silver and Platinum

Gold—There was no special demand on the open market in London, and prices of gold were unchanged at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. In New York about $4,000,000 additional was taken for Canada. This movement is apparently about over.

Imports of gold into France nine months ended Sept. 30 were 507,468,000 fr.; exports, 52,477,000 fr.; excess of imports, 454,991,000 fr., against 160,816,000 fr. last year.

Imports of gold in Great Britain 10 months ended Oct. 31 were £49,846,369; exports, £40,238,692; excess of imports, £9,607,677, against £4,661,767 last year.

Iridium—Conditions are unchanged and prices are unchanged at $80@81 per oz. for pure metal.

Platinum—Business is fair and prices are unchanged. Sales are made at $43@44 per oz., according to quantity. Hard metal brings $47@50 per oz., according to proportion of iridium.

Silver—Speculative conditions having forced silver down to 25⅛d. good buying orders have come in during the last two days and market closes on Wednesday at 26⅛d. with prospect of higher prices.

Shipments of silver from London to the East, Jan. 1 to Nov. 20, as reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£9,456,500	£9,195,500	D. £261,000
China	1,449,000	753,500	D. 695,500
Total	£10,905,500	£9,949,000	D. £956,500

Imports of silver at New York for the week were $151,452. Exports were $678,581 chiefly to London.

Imports of silver into France nine months ended Sept. 30 were valued at 279,807,000 fr.; exports, 265,133,000 fr.; excess of imports, 14,674,000 fr., which compares with an excess of exports of 2,352,000 fr. last year.

Imports of silver in Great Britain 10 months ended Oct. 31 were £12,586,606; exports, £13,896,188; excess of exports, £1,309,582, which compares with an excess of imports of £961,371 last year.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Nov. 29

The base price paid this week for 60% zinc ore was $40@41 per ton. Lead price for 80% ore remained the same as last week, $52@53 per ton.

SHIPMENTS WEEK ENDED NOV. 29

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,466,320	126,000	1,029,770
Year to date	136,355,310	5,123,080	185,580,610

Shipped during week to separating plants, 2,398,640 lb. zinc ore.

JOPLIN, MO.—Nov. 29

The high price offering of zinc blende this week is $43, the base per ton of 60% ranging from $38.50 to $41, the culmination of a decline that has been expected and feared for several weeks by producers, knowing the smelters have been losing money on prices current for many weeks. A further drop is feared next week to a $38 base. Few offerings were made until Saturday and consequently purchases were light. Calamine remains strong at $21@23 per ton of 40% zinc. The average price of all grades of zinc is $37.24. Lead sold as high as $54 per ton on an assay basis of $52 for ore of 80% metal content. The average of all lead is $51.74 per ton.

SHIPMENTS WEEK ENDED NOV. 29

	Blende	Calamine	Lead	Value
Totals this week	8,934,570	1,249,560	2,075,580	$243,375
Totals 48 weeks	524,529,620	40,237,000	88,115,320	$14,278,464

Blende value, the week, $175,255; 48 weeks, $12,326,145.
Calamine value, the week, $14,410; 48 weeks, $516,439.
Lead value, the week, $53,710; 48 weeks, $2,335,889.

IRON TRADE REVIEW

NEW YORK—Dec. 3

The trade continues generally quiet so far as new business is concerned. Operation of mills is still on a fair basis and there has not been as much closing down as might have been expected.

Structural steel has been rather quiet outside of the large Seaboard orders for subway and other municipal work. The trade in bars, plates and other forms has been rather better.

Pig iron is quiet and rather depressed. Steel-making irons have not been in much demand, but there has been more call for foundry pig.

PITTSBURGH—Dec. 2

Steel-mill operations have suffered but a slight decrease in the past week, and are now at about 55% of full capacity. The rate is declining slowly and it is improbable that it will go below 50% this month. Considering that all buyers are holding off as much as possible, and are endeavoring to draw upon stocks, the showing as to steel shipments is regarded as relatively favorable. The rate of buying is indicated quite closely by the rate of shipping, since not more than about 15% of current shipments are based directly upon old orders. There is some business nominally moving under old contracts, but it is practically new business as the price is readjusted to secure specifications for shipment.

Prices are showing somewhat more resistance to decline all along the line. Unfinished steel is off only a trifle, while in finished steel there are no marked declines to record. The mills now insist that the cost of production is higher, by $1 to $2 a ton, than when very low prices were made two years ago, and that the old level is not to be expected in this decline. Plates and bars remain quotable at 1.25c. and shapes at 1.30c., but on attractive orders these prices are frequently shaded.

Under date of Dec. 1, the National Tube Co. reduced 2-in. line pipe 1c. per foot, or about 10%, this being the only size of line pipe affected.

Pig Iron—The market has been absolutely stagnant, so that prices have been under no particular pressure. We quote former prices as representing the market generally: Bessemer, $15; basic, $13; No. 2 foundry, $13.50; forge, $13.25; Valley furnace, 90c. higher delivered Pittsburgh. W. P. Snyder & Co. announced their November averages, compiled from the actual sales reported in the trade of 1000 tons or over at $15.125, Valley, for bessemer and $13.013, Valley, for basic.

showing declines from October of 57.8c. in bessemer and 69.6c. in basic.

Ferromanganese—The market is quiet and unchanged except that prompt German material is offered occasionally at 50c. less than formerly, or at $49, Baltimore. English continues at $50 for prompt or forward.

Steel—While some of the mills insist they will not shade $21.50 on sheet bars there is some steel offered at $21, putting the market down 50c., while billets remain at $20.50, maker's mill, Pittsburgh or Youngstown. It is rumored that the December tonnages on monthly adjustment contracts were adjusted at a slightly lower level in some cases.

Foreign Trade of Germany in iron and steel nine months ended Sept. 30, metric tons:

	Exports	Imports	Excess
Iron and steel	4,807,873	472,381	Exp. 4,335,492
Machinery	418,354	72,522	Exp. 345,832
Total	5,226,227	544,903	Exp. 4,681,324
Total, 1912	4,778,705	563,322	Exp. 4,215,383

The exports this year included 52,653 tons of ferroalloys of various kinds.

IRON ORE

Lake Superior shipments are practically closed for the season. The shipments for last week were light. The last shipments from Lake Superior were made Nov. 30. The shipments for the season are estimated at 49,300,000 tons.

Imports at Baltimore during the past week included 38,827 tons iron ore, all from Cuba.

Imports of Iron Ore in Germany nine months ended Sept. 30 were 10,629,812 tons; exports, 1,355,882; excess of imports, 9,273,930 tons. Imports of manganese ore were 510,254 tons; exports, 6362 tons.

COKE

Connellsville Coke—A few operators have been endeavoring to close contracts, and have quoted $1.85 on furnace coke for 1914, if not less. Most operators regard $2 as the proper price and are not making any effort as yet to sell. Prompt furnace coke has been sluggish and has sold down 10c. a ton to $1.75. Foundry coke remains at 2.50@2.75 for prompt or contract.

Coal and Coke Tonnage Pennsylvania lines east of Pittsburgh and Erie 10 months ended Oct. 31, short tons:

	1912	1913	Changes
Anthracite	8,358,717	8,711,723	I. 353,006
Bituminous	38,227,609	42,662,163	I.4,434,554
Coke	10,882,963	12,012,363	I.1,129,400
Total	57,469,289	63,386,249	I.5,916,960

The total increase this year was 10.3%. The largest proportional gain was in bituminous coal. Coke has been falling off for two months past.

Spanish Imports of Coal eight months ended Aug. 31 were 1,818,354 metric tons, an increase of 332,243 tons over 1912. Imports of coke were 239,507 tons, a decrease of 2848 tons.

Austrian Coal Production for the nine months ended Sept. 30, in metric tons:

	1912	1913	Changes
Coal mined	11,656,476	12,234,247	I. 577,771
Brown coal mined	19,490,252	20,710,901	I. 1,220,649
Coke made	1,716,143	1,909,236	I. 193,093
Briquettes made	296,108	326,681	I. 30,573

Of the briquettes reported this year 175,502 tons were made from brown coal or lignite.

CHEMICALS

NEW YORK—Dec. 3

General business continues rather quiet and not much improvement is expected before the turn of the year.

Arsenic—Supplies are good, but buying is light. Canadian and American producers seem to be increasing output. Prices are nominally $3 per 100 lb., but might be shaded on a good order.

Copper Sulphate—A moderate business is reported. Prices are unchanged at $5 per 100 lb. for carload lots and $5.25 per 100 lb. for smaller parcels.

Nitrate of Soda—The market has been excited by the advent of a new distributing agency, which is disposed to compete for business. Sales have been good as buyers are disposed to put in supplies at the sharp cut made by the new sellers, who quote 2.15c. per lb. for all deliveries next year.

PETROLEUM

California oil production for the nine months ended, Sept. 30, was 73,125,142 bbl., an increase of 6,590,952 bbl. over 1912. The shipments or deliveries were 72,069,182 bbl., an increase of 11,150,796 bbl., over last year.

The monthly statement of the "Oil City Derrick" shows new oil wells completed in November as follows: Pennsylvania grade, 726; Lima-Indiana, 137; Kentucky, 14; Illinois, 165; Kansas-Oklahoma, 1129; Texas-Louisiana, 177. A grand total of 2348 wells was completed, with an initial production of 52,743. There were 350 dry holes and 162 gas wells.

Exports of mineral oils from the United States in October were 220,280,075 gal. For the 10 months ended Oct. 31 the total exports were 1,522,548,961 gal. in 1912, and 1,725,148,639 gal. in 1913; an increase of 202,599,678 gal., or 13.3%, this year.

COPPER SMELTER'S REPORTS

This table is compiled from reports received from the respective companies except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield then is reckoned at 97%. In computing the total American supply duplications are excluded.

	July	August	September	October	November
Alaska shipments	2,705,136	1,847,785	2,261,216	1,951,883	.....
Anaconda	22,100,000	22,500,000	22,600,000	18,400,000	25,250,000
Arizona, Ltd.	2,600,000	1,800,000	1,800,000	3,550,000	.....
Copper Queen	8,369,607	8,252,404	8,434,803	8,292,929	7,115,991
Calumet & Ariz.	3,800,000	4,500,000	4,000,000	4,500,000	.....
Chino	4,746,525	5,788,572	4,196,296	4,767,466	.....
Detroit	1,549,224	2,187,223	2,102,818	1,861,878	1,922,352
East Butte	1,060,257	1,162,007	1,233,018	1,040,997	.....
Giroux	584,546	524,953	198,178	156,084	.....
Mason Valley	908,892	867,060	918,000	1,052,000	.....
Mammoth	1,800,000	1,750,000	1,750,000	1,700,000	1,700,000
Nevada Con.	5,403,919	5,989,973	4,441,671	5,898,046	.....
Ohio	601,700	689,000	685,900	698,691	.....
Old Dominion	2,526,000	2,524,000	2,679,000	2,037,000	.....
Ray	4,097,000	4,269,519	4,336,434	4,725,419	.....
Shannon	880,000	1,248,000	1,232,000	1,216,000	.....
South Utah	140,000	223,498	241,843	232,269	.....
Tennessee	1,247,804	1,101,019	1,309,985	1,392,162	.....
United Verde*	3,000,000	3,000,000	3,000,000	3,000,000	.....
Utah Copper Co.	9,849,043	10,302,251	11,463,905	9,929,478	.....
Lake Superior*	17,500,000	9,700,000	6,950,008	5,500,000	.....
Non-rep. mines*	6,200,000	6,200,000	6,000,000	6,200,000	.....
Total prod.	101,669,653	96,427,264	91,835,075	88,102,302	.....
Imp., bars, etc.	29,029,990	22,474,471	35,703,660	.....	.....
Total blister	130,699,643	118,901,735	127,538,735	.....	.....
Imp. ore & matte	8,527,046	9,171,351	10,800,162	.....	.....
Total Amer.	139,226,689	128,073,086	138,338,897	.....	.....
Miami†	2,890,000	3,097,500	2,688,000	2,862,050	3,230,000
Shattuck-Arizona	1,019,388	1,001,634	1,163,237	993,224	.....
Brit. Col. Cos.:					
British Col. Cop.	618,379	647,905	621,120	.....	.....
Granby	1,664,102	1,847,344	1,824,659	1,718,258	.....
Mexican Cos.:					
Boleo†	2,240,720	2,264,640	2,369,920	2,424,800	.....
Cananea	3,328,000	3,186,000	3,148,000	3,682,000	.....
Moctezuma	2,693,006	3,542,047	3,024,121	3,178,136	3,517,800
Other Foreign:					
Braden, Chile	1,046,000	1,572,000	1,332,000	2,006,000	.....
Cape Cop., S. Af.	.....	.....	607,040	712,320	.....
Kyshtim, Russia	2,500,000	1,585,000	1,187,000	.....	.....
Spassky, Russia	660,800	1,048,320	1,025,920	983,360	.....
Exports from					
Chile	9,856,000	8,736,000	5,600,000	6,160,000	.....
Australia	10,304,000	7,720,000	6,944,000	7,728,000	.....
Arrivals-Europe‡	11,728,640	14,624,960	9,661,120	18,040,960	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.
‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
XI, '12	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	121,860,853	68,362,571	68,067,901	67,474,225	77,235,200	144,709,425
VII	138,074,602	58,904,192	78,480,071	52,814,606	71,904,000	124,808,606
VIII	131,632,362	73,649,801	73,263,469	53,594,945	66,420,480	120,015,385
IX	131,401,229	66,836,897	73,085,275	38,314,037	63,716,800	102,030,837
X	139,070,481	68,173,720	68,123,473	29,793,094	53,625,600	83,418,692
XI	.....	.....	.....	32,566,382	48,787,200	81,353,582
XII	.....	.....	.....	.....	46,592,000	.....

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq.	Sale	Amt.
Alta Cons. Utah	.....	.....	0.05
Blue Star, Ida.	Nov. 25	Dec. 17	0.03
Caledonia, Nev.	Nov. 24	Dec. 18	0.05
Cardiff, Utah	Nov. 20	Dec. 10	0.01
Clear Grit, Ida., postp'd	Nov. 18	Jan. 2	0.0025
Coeur d'Alene Invest., Ida.	Nov. 7	Dec. 8	0.003
Comet Placer, Nev.	Dec. 6	Dec. 22	0.03
East Hercules, Ida.	Nov. 15	Dec. 15	0.0015
Emerald, Utah	Nov. 15	Dec. 13	0.005
Empire, Ida., postp'd	Oct. 30	Jan. 2	0.005
Federal Ely, Nev.	Nov. 10	Dec. 10	0.005
Great Eastern, Ida.	Nov. 18	Dec. 18	0.0015
Laclede, Ida.	Nov. 24	Dec. 15	0.003
Nabob, Ida.	Nov. 17	Dec. 15	0.005
Nevada Silver Reed, Ida.	Nov. 17	Dec. 18	0.0017
North Franklin, Ida., postp'd	Oct. 16	Jan. 29	0.005
Raymond-Illinois, Utah	Nov. 28	Dec. 15	0.005
Scranton Ext., Utah	Nov. 17	Dec. 17	.00025
Silver Cliff, Ida.	Nov. 20	Dec. 10	0.005
Silver Star, Ida.	Nov. 22	Dec. 22	0.002
Snowstorm, Ida.	Nov. 13	Dec. 12	0.002
South Hecla, Utah	.....	.....	0.06
Utah Fertilizer, Utah	Nov. 8	Dec. 9	0.15
Wasatch, Utah	Dec. 22	Jan. 8	0.05
Wisconsin, Ida.	Nov. 10	Dec. 10	0.002
Wonder Pine Cr'k, Ida., postp'd	Oct. 3	Dec. 10	0.001

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	58.990	24.486	28.215	27.199
July	52.630	60.654	58.721	24.286	27.919	27.074
August	52.171	61.606	59.293	24.082	28.375	27.335
September	52.440	63.078	60.640	24.209	29.088	27.986
October	53.340	63.471	60.793	24.594	29.299	28.083
November	55.719	62.792	58.995	25.649	29.012	27.263
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.568	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.807
June	17.234	14.672	17.443	14.871	78.259	67.140
July	17.190	14.190	17.353	14.563	76.636	64.166
August	17.498	15.400	17.644	15.904	78.670	69.200
September	17.508	16.328	17.698	16.799	78.762	73.125
October	17.314	16.337	17.661	16.913	76.389	73.383
November	17.326	15.182	17.617	16.022	76.890	68.275
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.140
March	42.577	46.832	192.619	213.615
April	43.923	49.115	200.513	224.159
May	46.063	49.038	208.830	224.143
June	45.815	44.820	205.863	207.208
July	44.519	40.260	202.446	183.511
August	45.857	41.582	208.351	188.731
September	49.135	42.410	223.762	193.074
October	50.077	40.462	228.353	184.837
November	49.891	39.810	227.619	180.869
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	4.325	4.321	4.190	17.588	20.226
July	4.720	4.353	4.603	4.223	18.544	20.038
August	4.569	4.624	4.452	4.550	19.655	20.406
September	5.048	4.698	4.924	4.579	22.292	20.648
October	5.071	4.402	4.894	4.253	20.630	20.302
November	4.615	4.293	4.463	4.146	18.193	19.334
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	5.124	6.727	4.974	25.763	22.143
July	7.116	5.278	6.966	5.128	26.174	20.592
August	7.028	5.658	6.878	5.508	26.443	20.706
September	7.454	5.694	7.313	5.544	27.048	21.148
October	7.426	5.340	7.276	5.188	27.543	20.614
November	7.371	5.229	7.221	5.083	26.804	20.581
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	17.14	14.11	15.40	14.22	15.10
July	15.15	16.31	14.38	15.13	14.38	14.74
August	15.43	16.63	14.90	15.00	14.85	14.88
September	16.86	16.65	16.03	15.04	15.63	14.93
October	17.90	16.60	17.18	14.61	17.22	14.80
November	18.07	16.03	17.09	13.91	18.00	14.40
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Dec. 2		SALT LAKE Dec. 2	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	‡.02½	Beck Tunnel	.03
Cripple Cr'k Con.	‡.01	Black Jack	.05
C. K. & N.	‡.08	Cedar Talisman	.00½
Doctor Jack Pot	.06	Colorado Mining	.10½
Elkton Con.	.52½	Columbus Con.	‡.01
El Paso	2.80	Crown Point	.00½
Findlay	.01½	Daly-Judge	5.10
Gold Dollar	.07½	Grand Central	.50
Gold Sovereign	‡.02½	Iron Blossom	1.12½
Golden Cycle	‡2.00	Little Bell	‡.15
Isabella	.10½	Lower Mammoth	.01
Jack Pot	.04½	Mason Valley	3.25
Jennie Sample	‡.04	May Day	.05½
Jerry Johnson	‡.03½	Nevada Hills	.45
Lexington	‡.03	New York	‡.02½
Old Gold	.02	Prince Con.	.18
Mary McKinney	.57	Silver King Coal'n	3.25
Pharmacist	‡.01	Sioux Con.	.01
Portland	.97½	Uncle Sam	.04
Vindicator	.83½	Yankee	‡.06

TORONTO Dec. 2			
Name of Comp.	Bid.	Name of Comp.	Bid.
Bailey	.05½	Foley O'Brien	.17
Coniagas	7.00	Hollinger	17.25
T. & Hudson Bay	60.00	Imperial	‡.02
Timiskaming	.14	Jupiter	.07½
Wettlaufer-Lor.	.07	Pearl Lake	.12
Apex	‡.01	Porcu. Gold	.10
Big Dome	12.00	Preston E. D.	.01¼
Crown Chartered	.01	Rea	.10
Doble	‡.10	Swastika	.02
Dome Exten.	.04½	West Dome	.05

SAN FRANCISCO Dec. 2			
Name of Comp.	Bid	Name of Comp.	Bid
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	7.40
Belcher	.40	Jim Butler	.69
Best & Belcher	.04	MacNamara	.09
Caledonia	1.80	Midway	.34
Challenge Con.	.10	Mont.-Tonopah	.91
Chollar	.02	North Star	.39
Confidence	‡.35	West End Con.	1.27½
Con. Virginia	.09	Atlanta	.09
Crown Point	.30	Booth	.02
Gould & Curry	.03	C.O.D. Con.	.03
Hale & Norcross	.06	Comb. Frac.	.06
Mexican	1.05	Jumbo Extension	.08
Occidental	.70	Pitts.-Silver Peak	.35
Ophir	.18	Round Mountain	.34
Overman	.34	Sandstorm Kendall	.06½
Potosi	.02	Silver Pick	.03
Savage	.10	Argonaut	3.25
Sierra Nevada	.06	Bunker Hill	‡2.00
Union Con.	.11	Central Eureka	.23
Yellow Jacket	.32	So. Eureka	‡2.00

N. Y. EXCH. Dec. 2		BOSTON EXCH Dec. 2	
Name of Comp.	Clg.	Name of Comp.	Clg.
Amalgamated	69½	Adventure	1½
Am. Agri. Chem.	43½	Ahmeek	245
Am.Sm.&Ref.,com.	62½	Alaska Gold M.	19½
Am. Sm. & Ref., pf.	98½	Algomah	.95
Am. Sm. Sec., pf. B	81½	Allouez	30
Anaconda	33½	Am. Zinc	15½
Batopilas Min.	⅞	Ariz. Com., ctfs.	4½
Bethlehem Steel,pf.	69	Bonanza	.60
Chino	37½	Boston & Corbin	.50
Federal M. & S., pf.	31½	Butte & Balak	4½
GreatNor.,ore.,ctf.	31½	Calumet & Ariz.	60½
Guggen. Exp.	46	Calumet & Hecla	387
Homestake	118	Centennial	12½
Inspiration Con.	14	Cliff	‡1
Miami Copper	21½	Copper Range	32½
Nat'l Lead, com.	43½	Daly West	2½
National Lead, pf.	103½	East Butte	9½
Nev. Consol.	15½	Franklin	2½
Phelps Dodge	188	Granby	67½
Pittsburg Coal, pf.	87½	Hancock	12
Quicksilver, pf.	3	Hedley Gold	‡30
Ray Con.	17½	Helvetia	.25
Republic I&S,com.	19	Indiana	3
Republic I&S, pf.	78½	Island Cr'k, com	45½
SlossSheff'd,com.	26	Island Cr'k, pfd.	82
Sloss Sheffield, pf.	86	Isle Royale	17
Tennessee Copper	28½	Keweenaw	2
Utah Copper	47½	Lake	5½
U. S. Steel, com.	55½	La Salle	3 9/16
U. S. Steel, pf.	104½	Mass	2 1/16
Va.Car.Chem.,pf.	93	Michigan	‡.75
		Mohawk	39
N. Y. CURB Dec. 2		New Arcadian	1½
Name of Comp.	Clg.	New Idria Quick.	‡2½
Ariz. Belmont	‡.04½	North Butte	24
Barnes King	‡1⅛	North Lake	1
Beaver Con.	.30	Ojibway	.75
Big Four	.09	Old Dominion	47
Braden Copper	6½	Osceola	69
B. C. Copper	2½	Quincy	54
Buffalo Mines	1⅝	Shannon	6
Can. G. & S.	.12	Shattuck-Ariz.	25
Caribou	.62	Superior	21½
Con. Ariz. Sm.	3/16	Superior & Bost.	2½
Coppermines Cons.	1¼	Tamarack	‡25
Davis-Daly	1⅛	Trinity	3¼
Diam'field-Daisy	‡.03	Tuolumne	.75
Ely Con.	.02	U. S. Smelting	36½
Florence	.20	U. S. Smelt'g, pf.	46½
Gold Hill Con.	.20	Utah Apex	1⅛
Goldfield Con.	1½	Utah Con.	7¾
Greene Cananea	29½	Victoria	1½
Greenwater	.05½	Winona	1⅛
Internat. S. & R.	‡115	Wolverine	40
Kerr Lake	4½	Wyandot	.40
La Rose	13⅛		
McKinley-Dar-Sa.	1¼	BOSTON CURB Dec. 2	
Min. Co. of A. new	2	Name of Comp.	Bid
New Utah Bingham	.40	Bingham Mines	5
Nipissing Mines	8	Boston Ely	.46
Ohio Copper	7/16	Butte&Lon'nDev.	.32
Pacific Sm. & M.	‡⅛	Cactus	.02
Puebla S. & R.	2	Calaveras	1¼
South Utah M&S.	‡3/16	Chief Cons.	1⅛
Stand'd Oil of N.J.	387	Corbin	‡1
Stewart	1 5/16	Cortez	.20
Tonopah	5½	Crown Reserve	1¾
Tonopah Ex.	1⅜	Eagle & Blue Bell	.93
Tonopah Merger	.56	First Nat. Cop.	2 3/16
Tri-Bullion	1/16	Houghton Copper	2¼
Tularosa	1/16	Majestic	.22
Union Mines	‡.08	Mexican Metals	.33
United Cop., pfd.	3	Moneta Porc.	.01
Yukon Gold	2	Nevada-Douglas	1⅛
		New Baltic	.50
LONDON Nov. 22		Oneco	.80
Name of Comp.	Clg.	Raven Copper	.10
Camp Bird	£0 13s 6d	Rhode Island Coal	.01
El Oro	0 14 0	Smokey Dev.	.25
Esperanza	0 16 3	So. Lake	2¼
Mexico Mines	5 7 6	S. W. Miami	‡1⅛
Oroville	0 8 6	Tonopah Victor	.25
Santa Gert'dis.	0 16 3	Trethewey	.30
Stratton's	0 0 6	United Verde Ext.	.40
Tomboy	1 6 3		

‡Last Quotation.